Technical Reference Manual

LSGH®

Radiation-Based Detector with HART Electronics for Density Measurement

Document ID:
31558

Nuclear

Revision history

Manual version	Revision description
1.0	Initial release
1.1	Add RS-485 special application and Ohmview 2000 information
1.2	Electronics revision
1.3	Added certification information and IECex label
1.4	Changed company name, logo, and website

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VEGA Americas, Inc.
4170 Rosslyn Drive
Cincinnati, Ohio 45209-1599 USA

Voice:
(513) 272-0131

FAX:
(513) 272-0133

Web site:
www.vega-americas.com

Warning: Use this equipment only in the manner that this manual describes. If you do not use the equipment per VEGA specifications, the unit is not CE compliant, and may be damaged or cause personal injury.

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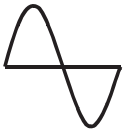
PREFACE

Explanation of symbols

Table P.1 lists the symbols that the manual and instrument use.

Table P.1 Explanation of symbols

	Radiation notice In the manual, information concerning radioactive materials or radiation safety information is found in the accompanying text.
	Caution In the manual, warnings concerning potential damage to the equipment or bodily harm are found in the accompanying text.
	**AC current or voltage** On the instrument, a terminal to which or from which an alternating (sine wave) current or voltage may be applied or supplied.
	DC current or voltage On the instrument, a terminal to which or from which a direct current voltage may be applied or supplied.
	Potentially hazardous voltages On the instrument, a terminal on which potentially hazardous voltage exists.

User's comments

VEGA values your opinion! Please fill out this page so that we can continually improve our technical documentation.

Manual: LSGH User Manual v 1.1 Date: _____

Customer Order Number: _____

How we can contact you (optional if you prefer to remain anonymous):

Name: _____

Title: _____

Company: _____

Address: _____

_____

_____

_____

Did you find errors in this manual? If so, specify the error and page number.

_____
_____
_____
_____

Did you find this manual understandable, usable, and well organized? Please make suggestions for improvement.

_____
_____
_____

Was information you needed or would find helpful not in this manual? Please specify.

_____
_____
_____

Please send this page to:
VEGA Americas, Inc.
Director of Engineering
4241 Allendorf Drive
Cincinnati, OH 45209-1599

CHAPTER

1

INTRODUCTION

Nuclear materials notice

This equipment contains radioactive source material that emits gamma radiation. Gamma radiation is a form of high-energy electromagnetic radiation. In many cases, only persons with a specific license from the U.S. NRC (or other regulating body) may perform the following to the source holder:

- Dismantle
- Install
- Maintain
- Relocate
- Repair
- Test

VEGA Field Service engineers have the specific license to install and commission nuclear gauges, and can instruct you in the safe operation of your level gauge. To contact VEGA Field Service, call 513-272-0131. Users outside the U.S. and Canada may contact their local representative for parts and service.

Refer to the *Radiation Safety for U.S. General and Specific Licensees*, *Canadian and International Users* Manual 239291, *Radiation Safety Manual Addendum of Reference Information* CD 244316, and the *Model SHGL Addendum to the Radiation Safety Manual* 244589 (if applicable) that came with the source holder and the appropriate current regulations for details.

Unpacking the equipment

Caution: *Make sure that you are familiar with radiation safety practices in accordance with your U.S. Agreement State, U.S. NRC, or your country's applicable regulations before unpacking the equipment.*

- ☑ Unpack the unit in a clean, dry area.
- ☑ Inspect the shipment for completeness, by checking against the packing slip.
- ☑ Inspect the shipment for damage during shipment or storage.
- ☑ If the detector is included as a separate package in the shipment, inspect the assembly for damage that may have occurred during shipment or storage.
- ☑ If there was damage to the unit during shipment, file a claim against the carrier, reporting the damage in detail. Any claim on the VEGA for shortages, errors in shipment, etc., must be made within 30 days of receipt of the shipment.
- ☑ If you need to return the equipment, see the section “Returning equipment for repair to Ohmart/VEGA” in the “Diagnostics and repair” chapter.
- ☑ After you unpack the equipment, inspect each source holder in the shipment to assure that the operating handle is in the OFF position. In the event that you find the handle in the ON position, place it in the OFF position immediately and secure it. **Note:** This is not applicable to all source holders.

Note: Most source holder models accept a lock. Call VEGA Field Service immediately for further instructions, at 513-272-0131, if the source holder has one of the following conditions:

- Does accept a lock and there is no lock on it
- The lock is not secured·
- You are unable to secure the lock
- The operating handle does not properly move into the OFF position

Refer to the *Radiation Safety for U.S. General and Specific Licensees, Canadian and International Users* Manual 239291, *Radiation Safety Manual Addendum of Reference Information* CD 244316, and the *Model SHGL Addendum to the Radiation Safety Manual* 244589 (if applicable) that came with the source holder and the appropriate current regulations for details.

Storing the equipment

Storing the source holder

If it is necessary to store the source holder, do so in a clean, dry area. Be sure the source holder shutter is in the OFF or CLOSED position (if applicable). Check the current local regulations (U.S. NRC, Agreement State, or other) to determine if this area must have any restrictions.

Storing the detector

Avoid storage at temperatures below freezing. Store the detector indoors in an area that has temperature-control between 10 °C ... 35 °C (50 °F ... 95 °F) and less than 50% relative humidity. Store equipment in dry conditions until installation.

Certifications

This gauge is designed for certi?cation compliance from the following agencies:

- ATEX Standard
- CCOE (India)
- CEPEL/INMETRO (Brazil)
- CSA
- FM Standard
- GOST-B Standard
- GOST-R Standard
- IECex
- JIS (Japan)
- KTL (Korea)
- NEPSI (China)

Safety Information for EX Areas

Please note the EX-speci?c safety information for installation and operation in EX areas.

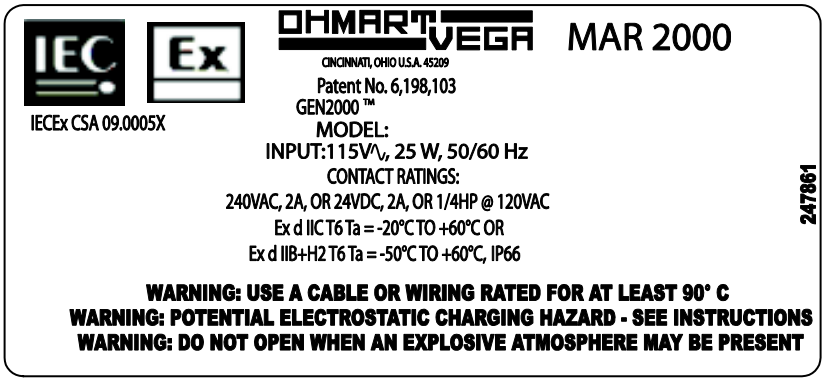

IECEx CSA 09.0005X
OHMART VEGA
CINCINNATI, OHIO U.S.A. 45209
MAR 2000
Patent No. 6,198,103
GEN2000 ™
MODEL:
INPUT:115V\, 25 W, 50/60 Hz
CONTACT RATINGS:
240VAC, 2A, OR 24VDC, 2A, OR 1/4HP @ 120VAC
Ex d IIC T6 Ta = -20°C TO +60°C OR
Ex d IIB+H2 T6 Ta = -50°C TO +60°C, IP66
247861
WARNING: USE A CABLE OR WIRING RATED FOR AT LEAST 90° C
WARNING: POTENTIAL ELECTROSTATIC CHARGING HAZARD - SEE INSTRUCTIONS
WARNING: DO NOT OPEN WHEN AN EXPLOSIVE ATMOSPHERE MAY BE PRESENT

Figure 1.1 IECex Label

LSGH specifications

Table 1.1 LSGH specifications

System Accuracy	±1% of span typical	Accuracy depends on specific application parameters
Typical Sources	Cesium-137	0.66MeV gamma radiation emitter, 30.2 year half life
	Cobalt-60	1.2 & 1.3MeV gamma radiation emitter, 5.3 year half life
Power Requirements*	AC	100-230 ±10% VAC (90-250VAC) at 50/60 Hz, at 15VA maximum power consumption (25VA max with heater) CE compliance requires 100-230 ±10% VAC
	DC	20-60VDC (less than 100mV, 1/1,000 Hz ripple) at 15VA CE compliance requires 24VDC±10%
	Wiring	1.63-0.643mm (#14-22AWG)
Signal Cable	Maximum length	1,000 m (3,280ft)
	HART signal	1.02-0.643mm (#18-22 AWG) two conductor shielded
GEN2000™ Electronics Housing	4-wire hookup with DC	1.02-0.643mm (#18-22 AWG) four conductor shielded
	Certification to CSA and UL standards	• Designed to meet National Electric Code (U.S. & Canada) • Class I, Groups A, B, C & D, Div 1 & 2 • Class II, Groups E, F & G, Div 1 & 2
	CENELEC certification	EExd IIC T5 (pending)
	Enclosure rating	NEMA 4X IP-66
	Ambient temperature	-20 °C ... 60 °C (-4 °F ... 140 °F) option for lower temperatures available
	Humidity	0-95%, non-condensing
	Vibration	Tested to IEC 68-2-6, IEC 68-2-27, and IEC 68-2-36
	Material	Cast aluminum ASTM A 357
	Paint	Polyester Powder Coating

Table 1.1 LSGH specifications (continued)

Weight	Housing detector	5.44kg (12lb)
Current Loop Output	Rating	4 ... 20 mA, isolated, into 250-800Ω
	Power	Jumper selectable: source (active) or sink (passive) mode.
Relay Output	Software user-settable	Diagnostic alarm or process high/low alarm function
	Rating	6A at 240VAC, or 6A 24VDC (SPDTForm C), or 1/4HP at 120VAC
HART® Communication	HART Protocol	BEL202 FSK standard current loop output
	PC interface	HART modem and VEGA communications software package
	Optional hand-held interface	HART Communicator model 275 hand-held terminal with VEGA device descriptions loaded
Auxiliary Input Capability	Type	Frequency input (0/100 kHz)
	Possible function	Optional NORM or vapor phase compensation, multiple gauge linking, & others
Electronics	On-board memory	FLASH and two EEPROMs
	Real-time clock	Maintains time, date, source decay compensation, and is Y2K compatible
Diagnostics	LED indication	+6V, Memory Corruption, HART, CPU Active, Auxiliary, High Voltage, Relay & Field Strength

* Power specifications change to 115VAC or 230VAC if an internal heater kit is used. For more information, see page C-1.

Typical applications

VEGA level gauges accurately indicate the level of liquids or bulk materials throughout a range on vessels, reactors, or tanks.

In order to achieve a level indication over the desired length, it may be necessary to use more than one detector. The manner in which these multiple detectors link together depends upon the types of detectors used. Specific details on using multiple detectors are available in Appendix B: “Special applications”.

Customer Service information

Field Service Engineers regularly assist customers over the phone.

If you have a question or need help, call Customer Service during office hours. If your problem is an emergency (for example, line shut down because of VEGA equipment), you can reach us 24-hours a day.

Table 1.2 Contact information

VEGA Phone	513-272-0131
VEGA FAX	513-272-0133

When calling with a question, if possible, please have the following information ready:

☑ VEGA Customer Order (C.O.) Number-Locate on the engraved label on the source holder

☑ Sensor serial number-Locate on the sensor housing inside the external housing

Principle of operation

The LSGH is a continuous level nuclear gauge. The gauge receives a shaped or collimated beam of radiation from the source holder through the process material. The material in the vessel acts as a shield that prevents a portion of the detector from exposure to the radiation field. As the process material level decreases, the detector senses more radiation. As the process material level increases, the detector senses less radiation.

Calibration of the level gauge associates the detector readings, known as counts, with the level of the material in engineering units. The output range of the gauge is a 4 ... 20 mA current loop signal, in proportion to the level of the process. See Appendix A: “Initial factory setup” for examples of process value settings.

System overview

The LSGH detector uses VEGA's GEN2000® electronics. The GEN2000 is VEGA's newest compact electronics that support 4 ... 20 mA HART® protocol, frequency, or field bus output. The level measurement system consists of three main components:

1. Source holder
2. Detector assembly LSGH
3. Communication device (HART modem with PC and VEGA software or HART Communicator model 275)

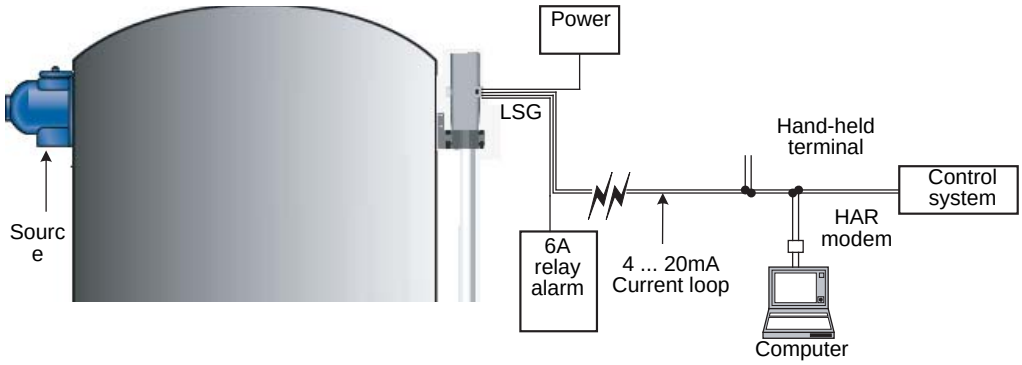


Figure 1.2 System overview

Source holder

- A cast or welded steel device that houses a radiation-emitting source capsule
- Directs the radiation in a narrow collimated beam through the process vessel
- Shields the radiation elsewhere
- The model chosen for each particular system depends on the source capsule inside and the radiation specification requirements
- A shutter on the source holder either completely shields the radiation (source off) or allows it to pass through the process (source on) (if applicable)

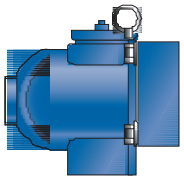


Figure 1.3 Typical source holder

Detector assembly

- Mounts opposite the source holder
- Inside the detector is a scintillation material
- The scintillation material produces light in proportion to the intensity of its exposure to radiation
- A photomultiplier tube detects the scintillator's light and converts it into voltage pulses
- The microprocessor receives these voltage pulses after amplification and conditioning by the photomultiplier tube
- The microprocessor and associated electronics convert the pulses into an output that can be calibrated

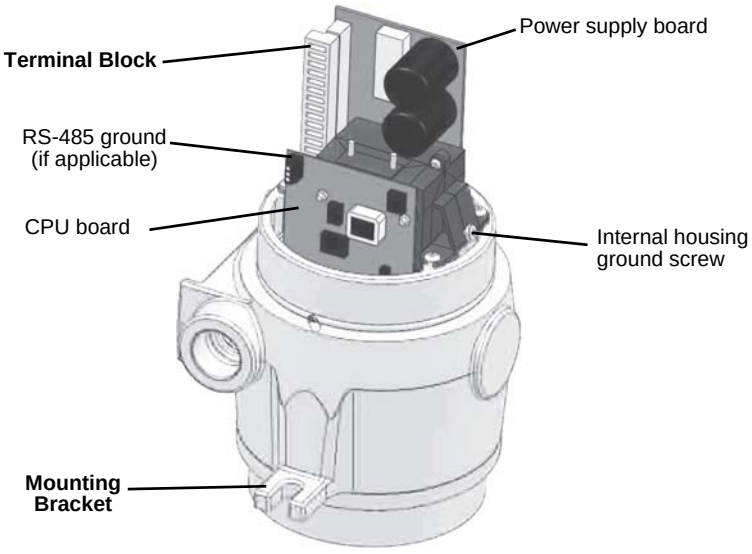


Figure 1.4 LSGH exploded view

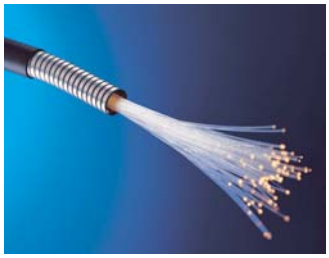


Figure 1.5 Scintillator material

Communicating with the gauge

The LSGH is a transmitter that produces the current loop signal directly at the measurement site.

Use either a HART Communicator or HART modem and VEGA View or Ohmview 2000 software with a PC to enable the following:

- Initial setup
- Calibration
- Other communication with the gauge

You can make a connection anywhere along the 4 ... 20 mA current-loop line. After setup and calibration of the level gauge, there are no day-to-day requirements for external electronics.

Using a universal hand-held terminal

VEGA's LSGH level gauge is compatible with the Fisher-Rosemount HART Communicator Model 275 or equivalent (VEGA part number 236907). The HART (Highway Addressable Remote Transducer) Communicator uses the Bell 202 Frequency Shift Keying technique to superimpose high frequency digital communication signals on the standard
4 ... 20 mA current loop. To function, the minimum load resistance on the 4 ... 20 mA loop must be 250ohms (Ω).

Note: In most cases, the procedures in this manual are based on using the hand-held terminal.

Refer to the instruction manual for your HART Communicator for information on the following:

- Key usage
- Data entry
- Equipment interface

In order to effectively use the features in VEGA's level gauge, you must use VEGA's device description (DD) to program the HART communicator. You may purchase a universal hand-held terminal, programmed with the device, through VEGA (VEGA part number 236907).

Use firmware 2000.00 or higher when you use the hand-held HART communicator to make NORM or vapor compensation. See Appendix B: “Special applications” for further information concerning NORM and vapor compensation.

Using VEGA View software on a PC

When you use an IBM-compatible personal computer to communicate with the LSGH, or other VEGA HART transmitter field device, you must have a HART modem and VEGA View software. The VEGA View software kit, part number 237857, includes the following:

- Modem
- Cables
- Software
- Manual

VEGA View software is a DOS program that emulates the HART Communicator Model 275. In addition, VEGA View enables the following:

- Charts the 4 ... 20 mA current output graphically
- Stores and retrieves configuration data to disk
- Off-line editing of configurations

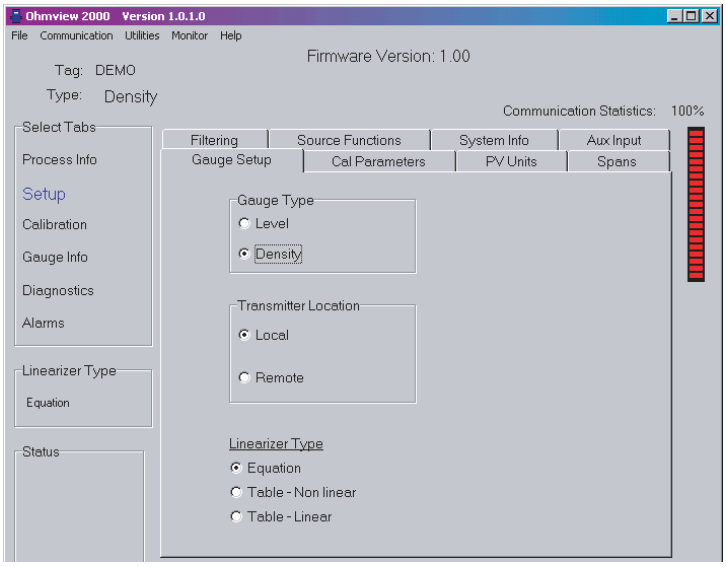


Figure 1.6 Example of VEGA View software

Note: There are some minor differences in operation of the VEGA View or Ohmview 2000 software and the hand-held communicator. Most significantly, VEGA View and Ohmview 2000 software writes entries immediately to the transmitter, but a hand-held communicator only sends changes after pressing F2. This manual's instructions are mainly for the hand-held communicator, but most procedures use exactly the same steps. Refer to the *VEGA View User Manual* or *Ohmview 2000 Electronic Manual*.

Using Ohmview 2000 Software on a PC

When you use an IBM-compatible personal computer with windows and a Pentium processor to communicate with the LSGH, or other VEGA HART transmitter field devices, you must have a HART modem and Ohmview 2000 software. The Ohmview 2000 software kit, part number 243008, includes the following:

- Modem
- Cables
- Software

Ohmview 2000, RS-485 Network, Ohmview 2000 Logger, and Ohmview 2000 Configurator software is a window's program that emulates the HART Communicator Model 275. In addition, Ohmview 2000:

- Charts the 4 ... 20 mA current output graphically
- Stores and retrieves configuration data to disk
- Off-line editing of configurations

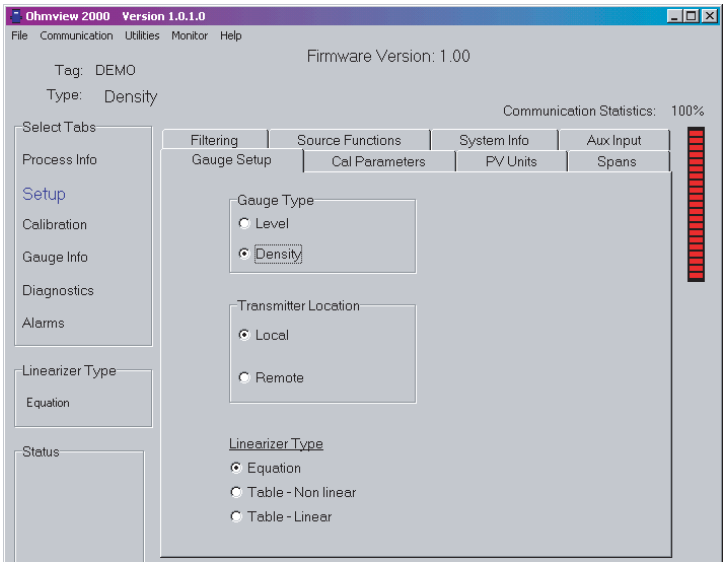


Figure 1.7 Example of Ohmview 2000 software

The Ohmview 2000 software includes the main Ohmview 2000 software, HART Communication Server, Launcher program, Ohmview 2000 Logger, Ohmview 2000 File Configurator, and the Ohmview 2000 Electronic User Manual. When you insert the disk into your CD drive, the program automatically starts installing these programs onto your hard drive.

Note: The HART Communication Server must always be on when using Ohmview 2000's main program and Ohmview 2000 Logger.

CHAPTER

2

INSTALLATION

Testing on the bench

To ensure a quick start up after installation, you can test the detector assembly with the HART compatible communication device (either a universal hand-held terminal or a personal computer with a HART modem and VEGA software). Bench testing enables you to check the following:

- Power
- Communication
- Initial setup software parameters
- Some diagnostics

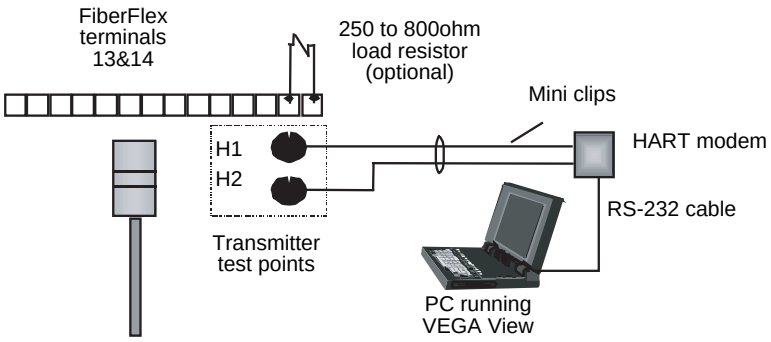


Figure 2.1 Bench test setup

Note: You may need to reset the time and date if the transmitter has not had power for over 28 days. The Real Time Clock Fail message may display. It is important to enter the correct time and date, because the clock is the basis for source decay calculations. For instructions to set the time and date, see page A-9.

Many users choose to calibrate the current loop output “on the bench” before mounting the detector on the process. Refer to page 3-1 for further information on calibration of the current loop.

Location considerations

At the time you ordered the level transmitter, VEGA sized the source for optimal performance. Notify VEGA prior to installation of the gauge if the location of the gauge is different from the original order location. Proper location of the level gauge can sometimes mean the difference between satisfactory and unsatisfactory operation.

Note: Try to locate the source holder in such a place that process material will not coat it. This ensures the continuing proper operation of the source ON/OFF mechanism (if applicable). Many regulatory agencies (for example, the U.S. NRC) require periodic testing of the ON/OFF mechanism.

Refer to the *Radiation Safety for U.S. General and Specific Licensees, Canadian and International Users* Manual 239291, *Radiation Safety Manual Addendum of Reference Information* CD 244316, and the *Model SHGL Addendum to the Radiation Safety Manual* 244589 (if applicable) that came with the source holder and the appropriate current regulations for details.

Stable temperature

Mount the level gauge on a portion of the line where the temperature of the process material is relatively stable. Process temperature can effect the gauge indication. The amount of the effect depends upon the following:

- Sensitivity of the gauge
- Temperature coefficient of the process material

Protect insulation

If insulation is between the measuring assembly and the process, protect the insulation from liquids. The absorption of a liquid, such as water, can affect the gauge indication because it blocks some radiation.

Avoid internal obstructions

The best possible installation of a nuclear level gauge is on a vessel that has no internal obstructions (agitator, baffle, manways, and so forth) directly in the path of the radiation beam. If one of these obstructions is present, it can shield the radiation from the detector, causing an erroneous reading. If the vessel has a central agitator, the source holder and detector can mount to the vessel on an arc other than a diameter, so that the beam of radiation does not cross the agitator. You can also avoid other obstructions this way.

Avoid external obstructions

Any material in the path of the radiation can affect the measurement. Some materials that are present when the gauge initially calibrates pose no problem because the calibration accounts for their effect. Examples of these materials are:

- Tank walls
- Liners
- Insulation

However, when the materials change or you introduce new ones, the gauge reading can be erroneous.

Examples of these situations are:

- Insulation that you add after calibration absorbs the radiation and causes the gauge to erroneously read upscale.
- Rapidly changing tank conditions due to material buildup. Regular standardizations compensate for slowly changing tank conditions due to material buildup. See the “Calibration” chapter for information on standardization.

Avoid source cross-talk

When multiple adjacent pipes or vessels have nuclear gauges, you must consider the orientation of the source beams so that each detector senses radiation only from its appropriate source. The best orientation, in this case, is for the source holders to be on the inside with radiation beams pointing away from each other.

Mounting the measuring assembly

There are two sets of mounting tab brackets (provided by VEGA) that bolt onto the brackets securely welded to the vessel (or in some cases, nearby structure).

Note: The detector active area (where it is possible to make a level measurement) is from the bottom of the sensor housing to approximately 76.2mm (3") from the bottom of the gauge.

Note: In some cases, the handle on the source holder operates a rotating shutter. When installing or removing the assembly from the pipe, you must turn the handle to the closed or OFF position and lock the handle with the combination lock that VEGA provides.

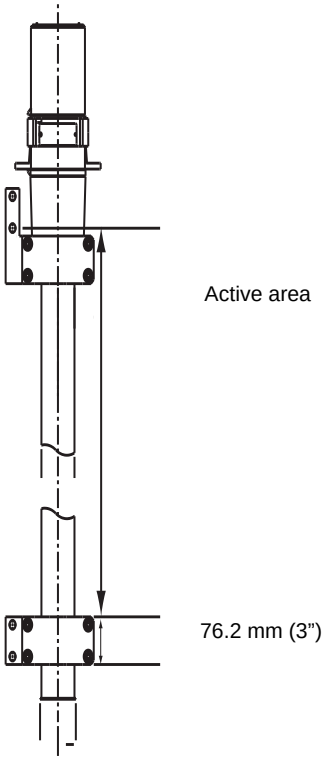


Figure 2.2 Mounting the detector

Wiring the equipment

Note: You may have received an interconnect drawing from VEGA or the engineering contractor. If the instructions on the drawing differ from the instructions in this manual, use the drawing. It may contain special instructions specific to your order.

Use the drawing notes and the steps that follow to make the input and output connections. Make the connections at the removable terminal strips mounted on the power board. Access the power board by removing the explosion-proof housing cap.

VEGA provides an internal and external ground screw for connection of the power Earth ground wire. After removing the top cover, the location of the internal ground screw is at the front of the housing. The location of the external ground screw is next to the conduit entry.

Note: Not all connections are required for operation. See Table 2.1: "Terminal names and descriptions".

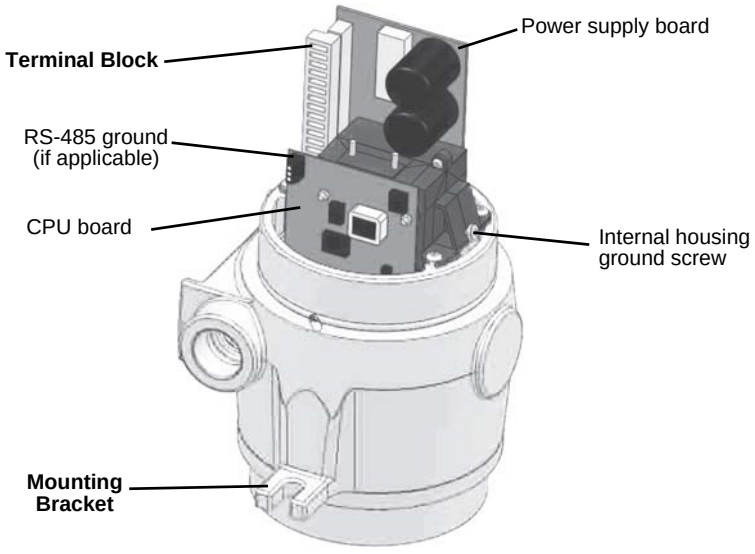


Figure 2.3 LSGH internal and external ground screw

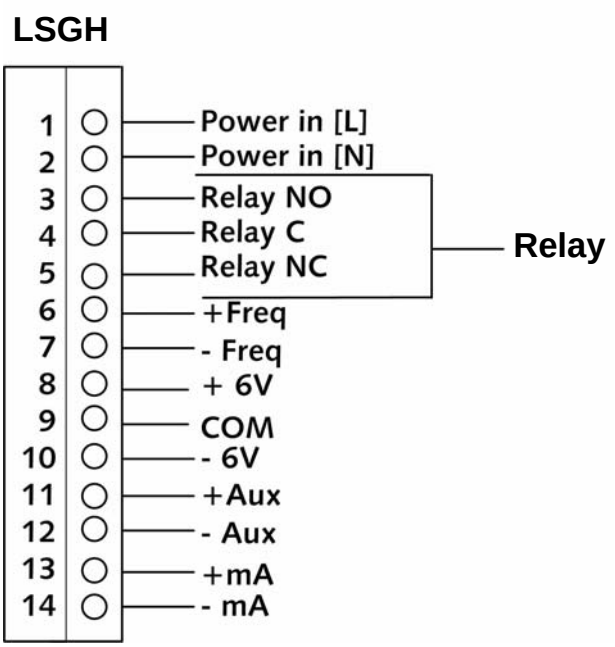


Figure 2.4 Interconnect

Table 2.1 Terminal names and descriptions

Terminal	Name	Description
1	L1	AC or DC power input
2	L2	AC or DC power input
3	RY NO	Relay normally open
4	RY C	Relay common
5	RY NC	Relay normally closed
6	Freq+	Not used in HART applications
7	Freq–	Not used in HART applications
8	+6	Auxiliary input power
9	COM	Auxiliary input power common
10	-6	Auxiliary input power
11	Aux+	Auxiliary input frequency signal
12	Aux–	Auxiliary input frequency signal
13	mA+	Positive current loop output
14	mA–	Negative current loop output

Note: The power input terminals are not polarity sensitive.

Power

Caution: *DO NOT APPLY POWER until a thorough check of all the wiring is complete!*

The AC power source voltage input is 100-230VAC±10% (90-250VAC) at 50/60 Hz, at 15 watts (without heater) or 25 watts (with optional heater) maximum power consumption. AC power must not be shared with transient producing loads. Use an individual AC lighting circuit. Supply a separate earth ground.

The DC power source voltage input is 20-60VDC (less than 100mV, 1/1,000 Hz ripple) at 15VA maximum power consumption. DC power cable can be part of a single cable 4-wire hookup, or can be separate from output signal cable. (See “Output current loop” section)

Use shielded two conductor wire (#18 or #20AWG) for power wiring. Use supply wire suitable for 40 °C above surrounding ambient temperature. All field wiring must have insulation suitable for 250 volts or higher.

Note: HART signal may not operate with some isolating barriers or other non-resistive loads.

Switch for CE compliance

For CE compliance, install a power line switch no more than one meter from the operator control station.

Output current loop

Output signal is 4 mA ... 20 mA into 250-800ohms (Ω).Pin 13 is positive and Pin 14 is negative. HART communication protocol (BEL202 FSK standard) is available on these connections. The output is isolated to standard ISA 50.1 Type 4 Class U.

When using signal (current loop or 4 ... 20 mA output) cables that VEGA did not supply, the cables should meet the following specifications:

- Maximum cable length is 1,000m (3,280ft)
- All wires should be #18 or #20AWG

When using DC power, the signal and power can run on a single cable 4-wire hookup (two wires for power, two for 4 mA ... 20 mA).

Relay

Use relay contacts rated at 6 A at 240VAC, 6A at 24VDC, or 1/4HP at 120VAC. Frequency input signal is 0/100 kHz maximum, true digital.

RS-485

The maximum cable length is 609 meters (2,000 feet). Use shielded wire (#18 or #20 AWG). Connect positive terminals together. Connect negative terminals together. Connect ground terminals together.

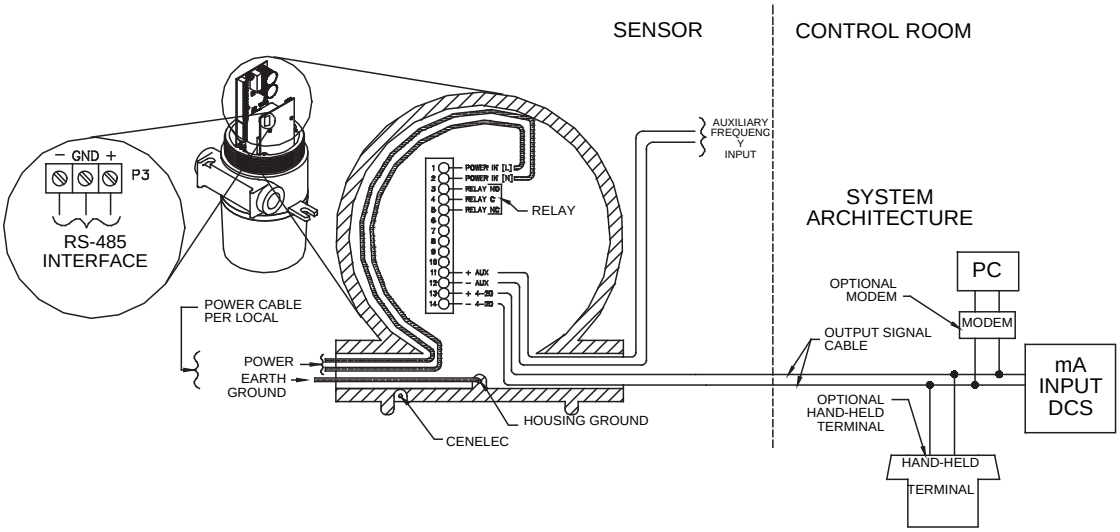


Figure 2.5 LSGH wiring diagram

Communication

The HART hand-held terminal can connect anywhere across the 4 ... 20 mA wires to communicate with the level transmitter. A minimum requirement is a 250Ω load-resistance on the current loop. The hand-held terminal is Rosemount model 275 or equivalent (VEGA number 236907).

A HART modem may also connect across the 4 ... 20 mA wires to enable communication between the level transmitter and an IBM compatible PC.

Process alarm override switch

If the output relay is set as a process alarm relay (high or low-level alarm), you can install an override switch to manually deactivate the alarm. If you do not install an override switch, the process alarm relay de-energizes only when the measured level is out of the alarm condition. The function of the output relay is set in the **Alarms** screen from the **Initial Setup** menu.

Conduit

Conduit runs must be continuous and you must provide protection to prevent conduit moisture condensation from dripping into any of the housings or junction boxes. Use sealant in the conduit, or arrange the runs so that they are below the entries to the housings and use weep holes where permitted.

You must use a conduit seal-off in the proximity of the housing when the location is in a hazardous area. Requirements for the actual distance must be in accordance with local code.

If you use only one conduit hub, plug the other conduit hub to prevent the entry of dirt and moisture.

Commissioning the gauge

Depending on the type of source holder, the process of commissioning the gauge can include the following:

- Taking appropriate radiation field tests
- Checking the pre-programmed setup parameters
- Calibrating on process
- Verifying the working of the gauge.

VEGA Field Service Engineers typically commission the gauge. It is necessary to remove the source holder lock or shield the first time the gauge takes measurements in the field.

Only persons with a specific license from the U.S. NRC, Agreement State, or other appropriate nuclear regulatory body may remove the source holder lock. If you have a source holder shield, refer to the *Model SHGL Addendum to the Radiation Safety Manual* 244589 for further instructions.

Note: Users outside the U.S. must comply with the appropriate nuclear regulatory body regulations in matters pertaining to licensing and handling the equipment.

Note: Refer to the *Radiation Safety for U.S. General and Specific Licensees, Canadian and International Users* Manual 239291, *Radiation Safety Manual Addendum of Reference Information* CD 244316, and the *Model SHGL Addendum to the Radiation Safety Manual* 244589 (if applicable) that came with the source holder and the appropriate current regulations for details.

Field service commissioning call checklist

In many U.S. installations, an VEGA Field Service Engineer commissions the gauge. To reduce service time and costs, use this checklist to ensure the gauge is ready for commission before the Field Service Engineer arrives:

- ☑ Mount the source holder and detector per the VEGA certified drawings.
- ☑ Allow access for future maintenance.
- ☑ Make all wiring connections per the certified drawings and the “Wiring the Equipment” section in this manual. Tie in the wiring from the field transmitter analog output to the DCS/PLC/chart recorder.
- ☑ Ensure that the AC power to the transmitter is a regulated transient-free power source. UPS type power is the best.
- ☑ If using DC power, verify that the ripple is less than 100mV, 1/1,000 Hz at 15 watts.

Note: The equipment warranty is void if there is damage to the gauge due to incorrect wiring not checked by the VEGA Field Service Engineer.

- ☑ Have process ready for calibration.
- ☑ When possible, it is best to have process available near both the low and high end of the measurement span.
- ☑ When possible, it is best to be able to completely fill and empty the vessel at the high and low levels for the initial calibration procedure, and at 10% increments in between for the linearization procedure.
- ☑ Do not remove the lock or shield on the source holder. Notify VEGA Field Service if there is damage to the source holder.

CHAPTER

3

CALIBRATION

Before using the level transmitter to make measurements, you must perform the following:

- Calibrate it to relate the detection of radiation from the source to the level of the process material
- Calibrate the current loop to a reference ammeter or the DCS
- Periodically, you must standardize the system on process to adjust for changes over time

Current loop (analog output) calibration

Calibrating the current loop adjusts the 4 ... 20 mA output to a reference-either the PLC/DCS or a certified ammeter. It forces the 4 and 20 mA outputs to the external reference. The VEGA factory pre-adjusts the current loop with a certified ammeter, so it is very close to the outputs required.

To correlate the 4 ... 20 mA to the process value, set the span of the current loop output in the **Loop Span** screen from the **Initial setup**, **Process parameters**, **Spans**, **Current Loops Span** menu. See the Appendix A: “Initial factory setup” section for details.

Note: The current loop and process spans are independent and set separately. The current loop span sets the level indications for the 4 mA and the 20 mA outputs. The process span sets the endpoints of the calibration curve. The current loop span and process span are set in the **Initial setup** screen from the **Main menu**.

A quick way to check the span settings is to use the **View settings** menu from the **Initial setup** menu.

A direct measurement of the current is preferable. Take this measurement by hooking the meter up in series with the instrument and the DCS. However, if you know the resistance of the DCS, use a voltage measurement to calculate the current.

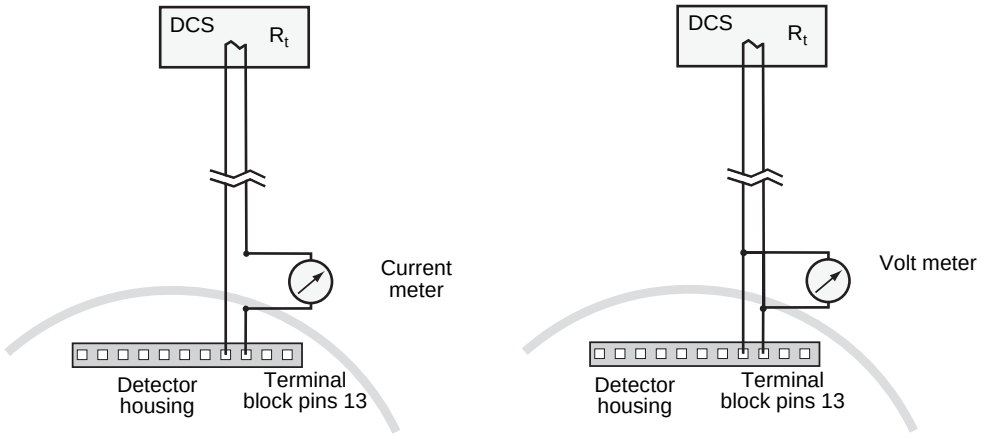


Figure 3.1 Measuring the current loop output

Before a current loop calibration:

☑ Connect an ammeter or the DCS to terminal connections 13 (mA +) and 14 (mA -), or the test points H1 and H2, or anywhere along the current loop.

☑ Make sure there is a 250-800Ω load on the current loop. If no load or an insufficient load exists on the loop, it may require temporary placement of a resistor across terminals 13 and 14. Hook the meter or DCS in series with the load resistor.

Calibrating the current loop

Procedure 3.1: Calibrating the current loop

1. Select **Calibrations | Current loop cal**.
   The Current loop cal screen prompts you to connect the reference meter.
2. Press F2.
   The screen displays, Setting Field Device Output To 4mA. The analog output circuit on the transmitter sets the current to approximately 4mA.
3. Read the ammeter and enter the actual milliamp reading.

Note: If using a voltmeter, calculate the current value.

4. The next screen prompts, Field Device Output 4.00 mA Equal to Reference Meter?
   - Choose **Yes** if the ammeter reads 4.00 mA.
   - Choose **No** if the ammeter reads anything but 4.00 mA.
5. Repeat until the meter reads 4.00 mA. The meter approaches the 4.00 mA successively.
6. Repeat procedure for 20 mA setting.

You can check the current loop output calibration at any time by using the test mode to output a user-specified milliamp setting. See page 4-7 for further information.

Initial process calibration

Calibration establishes a reference point or points that relate the detector output to actual (or known) values of the process.

You must make an initial calibration before the gauge can make measurements of any accuracy. Perform the initial calibration after the installation and commission of the gauge at the actual field site.

You do not need to repeat the initial calibration procedures as long as certain critical process and equipment conditions remain the same. See page 3-19 for further information. The gauge requires only a periodic standardization to compensate for changing conditions.

Choosing the initial calibration method

For each installation, the user must choose one of two ways to calibrate the level transmitter. The best calibration method depends on how you use the continuous level transmitter. Read the following table to decide which method to use.

Table 3.1 Calibration methods

Standard method	Simple method
Use the standard method if…the gauge is required to be repeatable and accurately indicate the level of process throughout the span.	Use the simple method if…the gauge is only required to be repeatable, but need not accurately indicate the level of process.
Typically used for vessels in which it is critical to know the accurate level.	Typically used for surge bins or other vessels under control that maintains one level.
The linearizer type chosen must be “Non-linear table”	The linearizer type chosen must be “Linear table”

Note: The simple calibration method produces a measurement indication that is repeatable but not accurate between the Cal Low Level and Cal High Level points. The measurement indication is not linear with respect to the actual process level.

In some applications, accuracy is not critical and this method is valid. If your application requires a linear or accurate indication of the actual process level, you must use the standard method of calibration.

Standard method of initial calibration

Figure 3.2 illustrates the steps to prepare for and perform a standard method calibration.

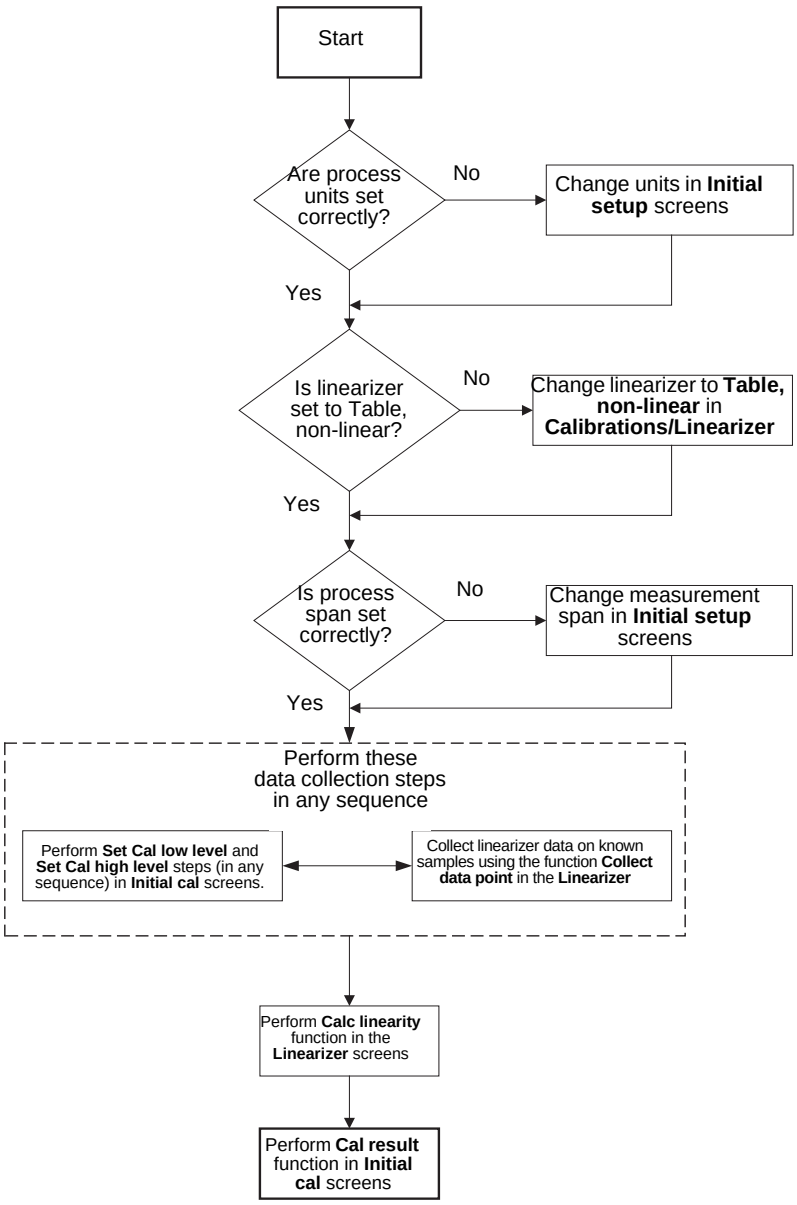

Start
Are process units set correctly?
No
Change units in **Initial setup** screens
Yes
Is linearizer set to Table, non-linear?
No
Change linearizer to **Table, non-linear** in **Calibrations/Linearizer**
Yes
Is process span set correctly?
No
Change measurement span in **Initial setup** screens
Yes
Perform these data collection steps in any sequence
Perform **Set Cal low level** and **Set Cal high level** steps (in any sequence) in **Initial cal** screens.
Collect linearizer data on known samples using the function **Collect data point** in the **Linearizer**
Perform **Calc linearity** function in the **Linearizer** screens
Perform **Cal result** function in **Initial cal** screens

Figure 3.2 Standard method calibration flow chart

Table 3.2 Standard method calibration

Standard method calibration		
Step in flow chart	**Manual heading**	**Page**
Check process engineering units	Units	A-3
Check process span	Span settings, process span	A-7
Check linearizer type, set to table, non-linear	Choosing the linearizer type	3-12
Check the repeatability of measurement	Checking the gauge repeatability	3-13
Perform “Set Cal low level” and “Set Cal high level”	Step 1: Set low level Step 2: Set high level	3-15 3-16
Collect linearizer data on known samples	Step 3: Collecting linearizer table data	3-17
Perform “Calc linearity”	Step 4: Calculating the linearity	3-18
Perform “Cal result”	Step 5: Calculate calibration	3-18

Simple method of initial calibration

Figure 3.3 illustrates the steps to prepare for and perform a simple method calibration.

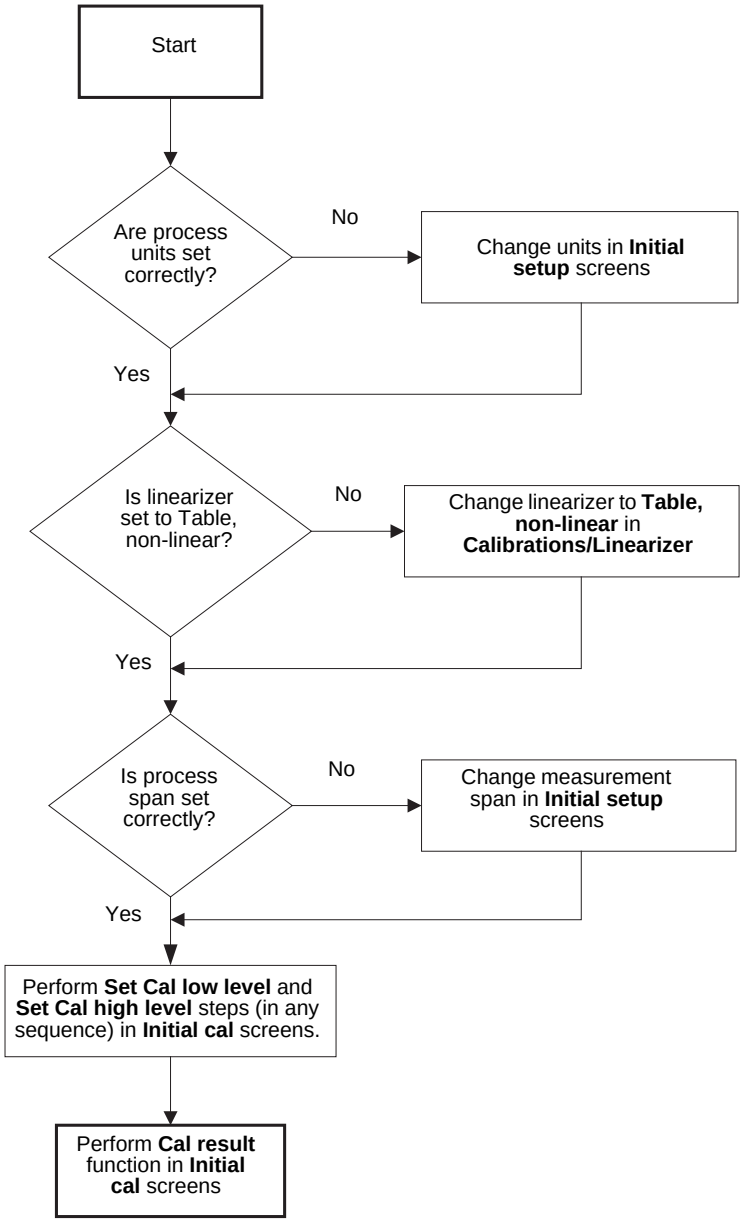

Start
Are process units set correctly?
No
Change units in **Initial setup** screens
Yes
Is linearizer set to Table, non-linear?
No
Change linearizer to **Table, non-linear** in **Calibrations/Linearizer**
Yes
Is process span set correctly?
No
Change measurement span in **Initial setup** screens
Yes
Perform **Set Cal low level** and **Set Cal high level** steps (in any sequence) in **Initial cal** screens.
Perform **Cal result** function in **Initial cal** screens

Figure 3.3 Simple method calibration flow chart

Table 3.3 Simple method calibration

Simple method calibration		
Step in flow chart	**Manual heading**	**Page**
Check process engineering units	Units	A-2
Check process span	Span settings, process span	A-7
Check linearizer type, set to linear table	Choosing the linearizer type	3-12
Check the repeatability of measurement	Checking the gauge repeatability	3-13
Perform “Set Cal low level” and “Set Cal high level”	Step 1: Set low level Step 2: Set high level	3-15 3-16
Perform “Cal result”	Step 5: Calculate calibration	3-18

Theory of initial calibration

This section explains both the standard and simple methods of calibration.

Both calibration methods

Enter the values that define the maximum and minimum levels to measure in the **Process span** screens, from the **Initial setup**, **Process parameters**, **Spans** menus. These parameters are Max Level and Min Level, and must be set correctly before any of the calibration steps.

Both calibration methods

Collection of data points nearest the Maximum (but not higher) and Minimum (but not lower) levels occurs during calibration. Refer to the “Two Point Cal” procedure in this manual for the steps necessary to collect these data points. In Figure 3.4, stars indicate the Maximum and minimum level data points.

Standard calibration method

A standard calibration method requires collection of intermediate data points. Use the **Linear data collect** function from the **Calibrations**, **Linearizer** menus to collect these data points. In Figure 3.4, circles indicate the intermediate data points.

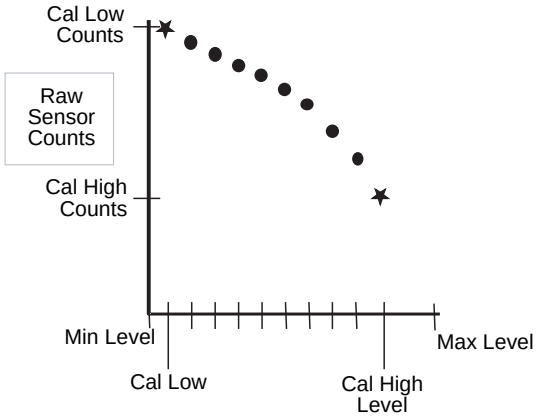


Figure 3.4 Linearizer data collected at various process levels

Simple calibration method

The simple method of calibration does not require collection of intermediate data points.

Standard calibration method

Internal software calculates a linearizer curve based on data points. The curve is the most accurate between the Cal Low Level and Cal High Level, as shown in Figure 3.5. For this reason, it is best to take the Cal Low and Cal High samples as close as possible to the Min Level and Max Level to maximize the accuracy within the span.

Simple calibration method

Based on the Cal Low Level and Cal High Level, the internal software calculates a straight line between the Min Level and Max Level.

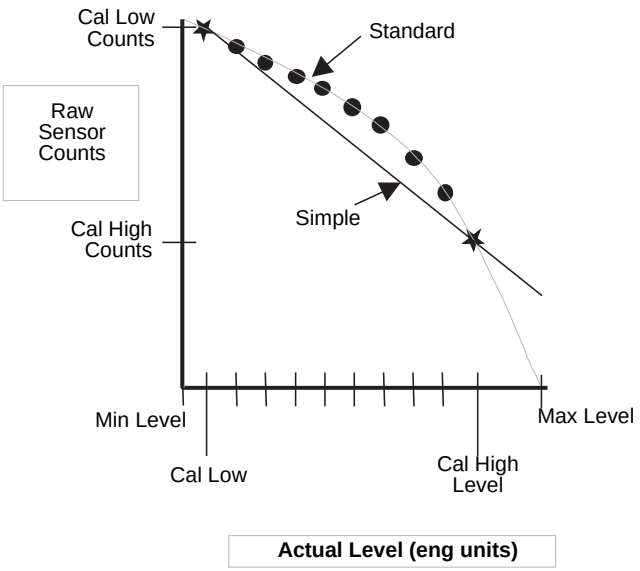


Figure 3.5 Raw counts vs. actual level with linearizers

Standard calibration method

The linearizer curve maps on two axes so that it indicates % Count Range vs. % Span, as shown in Figure 3.6. To construct the linearizer table, a data point calculates for every 2.5% of the span. View or edit these points in the Linearizer table screen.

Simple calibration method

The internal software calculates a straight line between the Min Level and Max Level based on the Cal Low Level and Cal High Level.

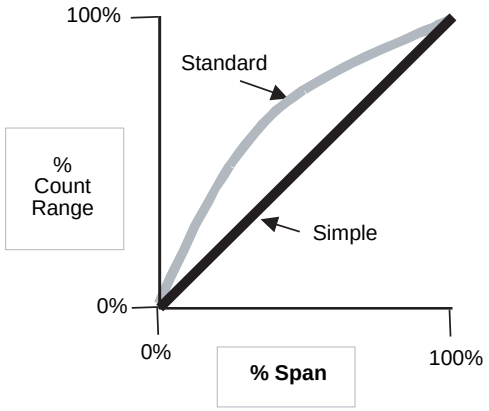


Figure 3.6 %Count range vs. %span (shown in linearizer table)

Both calibration methods

Figure 3.7 illustrates the effect on the final output of using the non-linear table vs. the linear table for the linearizer. Using the non-linear table linearizer in the standard method produces a linear output. Using the linear table linearizer table produces a non-linear output.

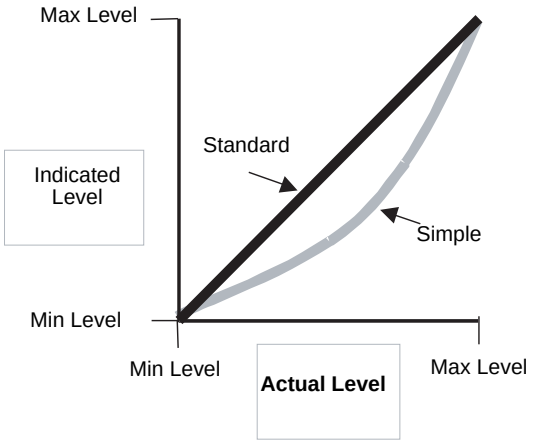


Figure 3.7 Indicated level vs. actual level

Choosing the linearizer type

The level transmitter response curve is non-linear, due to the measurement method of radiation transmission. The linearizer determines the shape of the curve between the endpoints.

As part of the signal processing necessary to produce a linear final output with respect to the change in level of process material, the level transmitter offers the following choices:

1. Non-linear table
2. Linear table

Non-linear table

Use this option for a standard method calibration. The non-linear table is more accurate than the linear table. This is because it the non-linear table takes into account the inherent non-linearity of a nuclear transmission measurement. The non-linear table can use data from the following:

- Linearizer look up table, data points that you collect and enter during the calibration process
- Linearizer data from an earlier model VEGA level gauge

Table, linear

Use this option for a simple method calibration. This option enables you to use a linear (straight-line) set of data for a linearizer look up table. You do not need to collect linearizer table data points. The straight-line linearizer calculates from the high and low-level initial calibration points. This requires you to perform the following:

- Two-point calibration
- Calculate the calibration

This is not as accurate because it does not compensate for the non-linearity of a radiation transmission measurement.

Choosing a linearizer method

Procedure 3.2: Choosing a linearizer method

1. Select **Main menu | Calibrations | Linearizer | Select linearizer**.
2. On the **Select linearizer** screen, the currently used linearizer is displayed on the second line.
3. From the **Select linearizer** screen, select either:
   - Table, non-linear
   - Table, linear
4. Press F2 to enter.

   Refer to Appendix C: “Preserving information from Smart Pro to the LSGH” for further instructions if you choose the Table, linear option.

Checking the gauge repeatability

Check the level transmitter measurement repeatability before performing the calibration.

Access the **Data collect** function in the **Data Collect** screen, from the **Calibrations** menu to enable simple measurement of the process, without altering the calibration or standardization values. It enables the system to measure the process and report the number of sensor counts. For more information about counts and the calculations performed to produce the final process value, see the “Process chain” section in the “Advanced functions” chapter.

You can perform a data collect three or four times on the same level to check the repeatability of the sensor. If the sensor counts vary widely, you should increase the Data collection interval parameter from the **Initial setup** menu, **Process parameters** menu, **Data coll interval** screen. Refer to page A-3 for further information.

Performing a data collect

Procedure 3.3: Performing a data collect

1. From the **Main menu**, select **Calibrations | Data collect**
2. At the prompt, select **Yes** to enable the data collection to take place. The on-screen counter displays the time left. Press F3 to abort if necessary to discontinue data collect.
3. After data collection, the screen displays the number of counts (cnts) output by the sensor. Make note of the counts value.
4. Repeat as often as necessary if checking repeatability.

Initial calibration

The standard calibration method involves five main steps:

1. Setting the low level and collecting Cal low data*
2. Setting the high level and collecting Cal high data*
3. Collecting linearizer data*
4. Calculating the linearizer
5. Calculating the calibration

* Perform these data collection steps in any sequence. Your ability to empty and fill the vessel determines the best sequence.

The simple calibration method skips Step 3 and 4.

If using the standard calibration method, you may find it helpful to record the sensor counts and levels at each step in Table 3.4.

Table 3.4 Standard calibration sensor counts and levels record

Data type	Sensor counts	Actual level (eng units)
Cal low level (usually empty)		
Linearizer data point 0		
Linearizer data point 1		
Linearizer data point 2		
Linearizer data point 3		
Linearizer data point 4		
Linearizer data point 5		
Linearizer data point 6		
Linearizer data point 7		
Linearizer data point 8		
Linearizer data point 9		
Cal high level (usually full) and Linearizer data point 10		

Step 1: Set low level

Setting the low level for calibration requires the following activities:

- Measurement with the level transmitter of the low process level
- Entry of the actual level

This sets the low end (sometimes referred to in the U.S. as “zero”) of the calibration curve. Perform this procedure either before or after setting the high level.

Note: Perform the data collection for the low and high level within ten days of each other for a good calibration. The low and high values must be more than 10 percent of the process span apart for the most accurate calibration. Increasing the process span usually increases the gauge accuracy.

Before starting the cal low data collection:

☑ Fill vessel to its low level

☑ Have actual level value ready to enter

Setting the cal low level

Procedure 3.4: Setting the cal low density

1. From the **Main menu**, select **Calibrations | Initial cal | Two point cal | Set Cal low level**.
2. The prompt, “Set process to desired value. Take data? “displays. Select **Yes** to start the data collection. The on-screen counter displays the time left. If necessary, press F3 to discontinue data collection.
3. After collection of the data, the screen prompts you to input the actual value. Input the actual value in engineering units.
4. If using a hand-held Communicator, press F2 to send the calibration setting to the level gauge.

Step 2: Set high level

Setting the high level for calibration requires the following activities:

- Measurement with the level transmitter of the high process condition
- Entry of the actual level

This sets the “gain” of the calibration curve. Perform this procedure either before or after setting the low level.

Note: You must perform data collection for the low and high level within ten days of each other for a good calibration. The low and high values must be more than 10 percent of the process span apart for the most accurate calibration. Increasing the process span usually increases the gauge accuracy.

Before starting the cal high data collection:

☑ Fill vessel or pipe with high process, or close the source holder shutter to simulate high process.

☑ Have actual level ready to enter.

Setting the cal high level

Procedure 3.5: Setting the cal high level

1. From the **Main menu**, select **Calibrations | Initial cal | Two point cal | Set Cal high level**.
2. The prompt, Set Process To High Calibration Point. Take Data? displays. Select **Yes** to allow the data collection to take place. The on-screen counter displays the time left. If necessary, press F3 to discontinue data collection.
3. After data collection, the screen prompts you to input the actual value in engineering units. The prompt, Input Actual Value, displays. Enter the actual level in engineering units.
4. If using a hand-held communicator, press F2 to send the calibration setting to the level transmitter.

Step 3: Collecting linearizer table data

Note: The simple method of initial calibration does not use this step.

This step allows you to collect data points between the high and the low calibration points so that the VEGA level transmitter calculates a response curve based on your data.

Note: VEGA View and Ohmview 2000 users: The linearizer data collection procedure is significantly different in VEGA View. Refer to the VEGA View User Manual for instructions to collect linearizer data.

Before collecting the linearizer table data:

- ☑ Prepare to set the level and take data. Ten levels (including the Cal low and Cal high levels) are the maximum.
- ☑ Prepare to enter the levels into the transmitter.
- ☑ You can collect linearizer table data along with the data collection for the Cal low and Cal high levels.

Collecting linearizer table data

Procedure 3.6: Collecting linearizer table data

1. From the **Main menu**, select **Calibrations | Linearizer | Linearizer data | Linear data collect | Collect datapoint**.
2. At the prompt, enter the actual known level of process.
3. Accept or reject the results when they display.
4. Repeat procedure for all available levels.
5. Press F2 to send.

Note: Include the data for the Cal low and Cal high with the linearizer data before you perform Calculate linearity. If you did not perform a linearizer data collect while the process was at the levels for Cal low and Cal high, you can manually add those values to the linearizer data.

To add a data point to the linearizer data, you must know the level in engineering units and the sensor counts. Go to the **Add new data pt** screen, from the **Calibration**, **Linearizer**, **Linearizer data**, **Linear data collect** menus, and follow the prompts to enter the data.

Step 4: Calculating the linearity

Note: The simple method of initial calibration does not use this step.

After collecting the data for a linearizer table, the transmitter uses the data to calculate a new calibration linearizer table. The **Calc linearity** function initiates this calculation. You must perform this step before the Calculate Calibration step, described in the next section.

Calculating a new linearizer table

Calculate the linearizer after you perform the following steps:

- Select non-linear table for the linearizer curve.
- Collect linearizer data.

Procedure 3.7: Calculating the linearizer

1. From the **Main menu**, select **Calibrations | Linearizer | Linearizer data | Linear data collect | Calc linearity**.
2. At the prompt, select **Yes** to proceed with the linearity calculation. The linearizer table calculates based on the level values.
3. Press F2 to save.

Step 5: Calculate calibration

After collecting the high and low level calibration data and calculating the linearity, the level transmitter is ready to make the calibration calculation.

Calculating the calibration result

Procedure 3.8: Calculating the calibration result

1. From the **Main menu**, select **Calibrations | Initial cal | Two point cal | Cal result**.
2. The screens display the results of the cal low and cal high sensor counts and values. Review the values. You can manually edit the counts and actual or new data can be collected by repeating the Set low and Set high procedures, or press F2 to continue.
3. The prompt, Proceed with Calibration Calculation?, displays. Select **Yes** to proceed with the calculation.
4. Press F2 to save.

When a new initial calibration may be necessary

Under most circumstances, you do not need to repeat the initial calibration procedure. The system requires only periodic standardization to compensate for drifts over time. However, certain events necessitate a new initial calibration. The events are:

- Measurement of a new process application (contact VEGA for recommendation)
- Process requires a new measurement span
- Entry of a new measurement span setting into the software
- Installation of a new radiation source holder
- Moving the level transmitter to another location (in U.S. only specifically licensed persons may relocate the gauge)
- Changes to the process vessel, for example: lining, insulation, or agitator
- Excessive build up or erosion of vessel that standardization cannot compensate for (check standardize gain)
- Standardize gain is greater than 1.2 after a standardization, indicating it made a 20% adjustment from the initial calibration

Periodic process standardization

Standardization adjusts the system by resetting one point of the calibration curve to an independently measured or known level.

The frequency of standardization depends on several factors, including desired accuracy of the reading.

During the standardization procedure, the system displays either:

- A default value for the standardization condition
- A prompt to enter the actual level of the standardization condition

The Initial factory setup appendix details how to set up the software for either prompt.

Automatic standardization reminder

If you enable the standardization due alarm, the level transmitter alarms when standardization is due. The standardize interval is programmed into the calibration parameters setup. Refer to Appendix A: “Initial factory setup”, for details on the following subjects:

- Output relay setup
- Standardization due alarm
- Standardization interval

Performing a standardization

Standardizing the gauge

Procedure 3.9: Standardizing the gauge

1. From the **Main menu**, select **Calibrations | Process stdz**.
2. The **Process stdz** screen prompts if you want to take data. Select **Yes** if you are ready with the standardization material in the process vessel to continue the standardization procedure. The timer counts down while it is collecting data.
3. Depending on how the system is set up, it displays one of the following:
   - The message, Gage Set up to Use Default Value, indicates the system is using the default value as the actual value of the standardization material.
   - A screen that displays the detector counts, the calculated process value, and a field for the user to input the actual value of the level. The prompt asks, Edit Counts? Select **No** to continue or **Yes** to input the average counts.
4. Press F2 to send.

CHAPTER

4

ADVANCED FUNCTIONS

Functions not required for normal operation of the transmitter are found in the software menu structure under the heading, **Advanced Fxns**. These functions are primarily for use by VEGA personnel for advanced troubleshooting and repair. This chapter gives a basic explanation of these functions.

Note: VEGA strongly recommends that you ask our advice before using any of these advanced functions.

Process chain

The process chain is a description of the transmitter software's calculation of a level measurement from a radiation reading. In the **Process chain** screen, you can view intermediate values of the calculation to verify proper functionality of the software.

Primary channel

Press the hot spot key (↴↴↴) on the hand-held communicator to display the **Primary channel** screen. The display values for the **Primary channel** screen are:

Table 4.1 Primary channel screen-display values

Value	Description
Temp	The internal probe's measurement of the sensor temperature
Sensor cnts	The counts that are true counts output, from the sensor, before application of the following: • Temperature compensation • Standardize • Sensor uniformity gains
TC counts	The temperature compensated counts that are sensor counts with application of temperature compensation

Table 4.1 Primary channel screen-display values (continued)

Value	Description
Raw counts	The raw counts that are temperature compensated counts with application of uniformity gain
Adj counts	The adjusted or sum counts that are raw counts plus auxiliary raw counts. In most applications, this does not use auxiliary input, so sum counts are equal to raw counts.
SD counts	The source decay counts that are sum counts with application of source decay gain
Stdz counts	Displays standardize counts that are source decay counts with application of standardization gain
% Cnt range	The compensated measurement counts that express as a percent of the counts at the high and low-endpoints of the calibration (determined with the two point initial calibration.) This quantity shows where the current measurement is in relation to the total count range. $\%\ \text{count range} = 100 \times (C_L - C_S) / (C_L - C_H)$ where C_S = sum counts C_L,C_H = counts at Cal low level and Cal high level C_L-C_H = counts range
% of span	The measurement value as a percent of the measurement span. The maximum and minimum level values are input in the **Initial setup** screens. A graph of percent count range vs. percent process span indicates the non-linearity of the radiation transmission measurement. If using a table linearizer, the values in the table are percent count range and percent process span.
Raw level	The level in inches without the time constant or rectangular window filter
Uncomp Lvl	The level in inches without the time constant or rectangular window filter
Level	The process value that is the level or other indication in engineering units, after applying the filter. This value relates to the current loop output.

Process variables

The process variables screen displays the values in Table 4.2.

Table 4.2 Process variable screen display values

Value Name	Description
Counts low	The temperature and sensor uniformity gain compensated counts from the sensor at the Cal low level. Determination of the Cal low level occurs during the initial calibration procedure.
Counts high	The temperature and sensor uniformity gain compensated counts from the sensor at the Cal high level. Determination of the Cal high level occurs during the initial calibration procedure.
Max level	The value, in process units, as entered in the Initial setup screens. Use this to calculate the measurement span.
Min level	The value, in process units, as entered in Initial setup screens. Use this to calculate the measurement span.
Temp comp gain	The current value of the temperature compensation gain. Use this to adjust for inherent sensor output change with temperature.
Uniformity gain	The current of the uniformity gain. Use this to force all level sensors to output the same counts at a given radiation field. Most level applications do not use uniformity gain and have it set as default value of 1.0.
Source decay gain	The current value of the source decay gain. Use this to compensate for the natural decay of the radiation source, which produces a lower field over time.
Stz gain	The current value of the standardize gain that adjusts with each standardize procedure.
HV setting	The set point for the sensor high voltage.

Aux channel chain

The Aux channel chain screen displays the values in Table 4.3.

Table 4.3 Auxiliary channel chain screen display values

Value Name	Description
Aux raw counts	The frequency-input counts from optional auxiliary input.
Filt counts	The filtered auxiliary counts. The filter dampening value is the number to enter for the auxiliary input filter time constant.

Min/Max history

The min/max history displays the minimum and maximum value for parameters since the last min/max reset. Table 4.4 lists these display values.

Table 4.4 Min/Max history screen-display values

Value Name	Description
Temp min/max	The internal temperature of the scintillator sensor in the LSGH model level transmitter
Sensor min/max	The raw uncompensated counts from the detector
Aux in min/max	The auxiliary input counts (if used)
Last reset	The date of the last min/max reset

Resetting the minimum and maximum history

You can reset the minimum and maximum history values so that they record from the time of the reset.

To reset the minimum and maximum history

Procedure 4.1: Resetting the minimum and maximum history

5. From the **Main menu**, select **Advanced Fxns | Min/max history**.
6. From the **Min/max history** screen, select **Reset min/max**.
7. When prompted, select **Yes** to reset the min/max values, or select **No** to cancel.
8. Press F2 to save.

New hardware or EEPROM corrupt

The transmitter contains two electrically erasable programmable read only memory (EEPROM) chips. The EEPROMs store all data specific to that sensor/electronics pair for the installation. The locations of the EEPROMs are:

- On the CPU board
- On the sensor board

Each EEPROM contains a backup of the other EEPROM. The system monitors both EEPROMs at power-up to assure an accurate backup.

If you install a new CPU board, the EEPROM performs a backup of information on the CPU and the sensor boards do not match. The software signals the discrepancy with the error message, “New Hardware Found”. The transmitter does not automatically perform a backup in case the discrepancy is not due to new hardware, but some corruption of the EEPROM.

Note: Only use the **New hardware** functions if you replace the CPU board. This function is not necessary if installing a completely new detector assembly. The new detector assembly includes the CPU board and the sensor assembly.

Proper response to “New hardware found” message if new hardware has been installed

When you install a new CPU board, you must verify installation in the New hardware screen. This function enables new backups of the EEPROMs.

If a new CPU board has been installed

Procedure 4.2: New Hardware Found message with new CPU board

1. From the **Main menu**, select **Advanced Fxns | New hardware | New CPU board**.
2. The prompt, Verify New CPU Board Installed displays. Select **Yes** to allow new backups on the EEPROMs or select **No** to cancel.

Proper response to “New hardware found” message if new hardware has not been installed

CPU EEPROM Corrupt message or Sensor EEPROM Corrupt message

If there has not been an installation of a new CPU board and the error message, New Hardware Found, displays, then one of the EEPROMs is probably corrupt. You normally can repair the corruption with the EEPROM backup.

Caution: *If you suspect that an EEPROM is corrupt, we recommend you call VEGA Field Service for advice before performing the following procedure.*

To repair the corruption from the EEPROM backup

Procedure 4.3: Repairing corrupted EEPROM

1. From the **Main menu**, select **Advanced Fxns | New hardware | No new hardware**.
2. At the prompt, Do You Want To Reconcile Differences?, select **Yes** to allow restoration from backups on the EEPROMs, or select **No** to cancel.

Test modes

Five independent test modes are available. These test modes are:

1. mA Out test mode
2. Sensor test mode
3. Aux Inp test mode
4. Relay test mode
5. Temperature test

In the test modes, the transmitter stops measuring the process material and allows manual adjustment of critical variables for troubleshooting. The test modes function independently. However, you can use them in combination to test multiple variable effects. All of the test modes time out automatically after one hour if you do not manually exit.

Caution: *While in a test mode, the transmitter is not measuring process and so its current output does not reflect the process value. If your DCS is controlling from the transmitter's current output, be sure to remove the system from automatic control before entering a test mode. The software screens prompt you to do so before entering test mode.*

Milliamp output test mode

Use the milliamp output test mode to manually force the current output to a specified value. This is useful for verifying the current loop calibration. Instructions to calibrate the current loop are available in the “Calibration” chapter of this manual.

Note: While in milliamp test mode, the HART communication may post a Status error. This is expected and not an indication of a failure. If the message, “Status Error – Ignore Next xx Occurrences?” displays, select **Yes** to ignore the Status Error.

Start milliamp output test mode

Procedure 4.4: Start mA output test mode

1. From the **Main menu**, select **Advanced Fxns | Test mode | mA Out test mode | Enter mA test mode**.
2. At the prompt, enter the value of the current output you want to force.
3. At the prompt, select **Yes** to start the test mode and send new data.
4. The transmitter continues functioning in milliamp test mode until it times out after one hour, or until you choose **Exit mA test mode**.

Exit milliamp output test mode

Procedure 4.5: Exit mA output test mode

1. From the **Main menu**, select **Advanced Fxns | Test mode | mA Out test mode | Exit mA test mode**.
2. At the prompt, select **Yes** to exit the test mode.

Sensor test mode

The sensor test mode simulates the sensor output at a user-defined number of raw counts. This is before application of the following:

- Temperature compensation
- Sensor uniformity gain
- Standardize gain

The true sensor output is ignored while the transmitter is in sensor test mode.

Sensor test mode is extremely useful for verifying the electronics' and software response to input counts without having to perform the following:

- Change the process
- Shield the source
- Vary the radiation field

While in sensor test mode, after entering the desired number of counts, it may be useful to look at the **Process chain** screen to view the variables affected by the raw counts value. To view the **Process chain** screen, back out of the test mode screens pressing the LEFT ARROW. The transmitter continues to operate in sensor test mode until it times out after one hour or until you choose **Exit test mode**.

Start sensor test mode

Procedure 4.6: Start Sensor test mode

1. From the **Main menu**, select **Advanced Fxns | Test mode | Sensor test mode | Enter test mode**.
2. At the prompt, enter the value of the new counts you want to force.
3. At the prompt, select **Yes** to start the test mode and send new data.
4. The transmitter continues functioning in sensor test mode until it times out after one hour, or until you choose **Exit test mode**.

Exit sensor test mode

Procedure 4.7: Exit Sensor test mode

1. From the **Advanced Fxns** menu, select **Test mode | Sensor test mode | Exit test mode**.
2. At the prompt, select **Yes** to exit the test mode.

Auxiliary input test mode

The auxiliary input test mode simulates the auxiliary input frequency at a user-defined number of counts. The effect of auxiliary input counts depends on the auxiliary input mode. Examples are:

- Temperature probe
- Flow meter
- Second transmitter

While in auxiliary input test mode, after you enter the desired number of counts, it may be useful to look at the **Process chain** screen to view the variables affected by the auxiliary input counts value. To view the **Process chain** screen, back out of the test mode screens using the LEFT ARROW. The transmitter continues to operate in auxiliary input test mode until it times out after one hour or until you choose **Exit auxiliary input test mode**.

Start auxiliary input test mode

Procedure 4.8: Start Auxiliary test mode

1. From the **Main menu**, select **Advanced Fxns | Test mode | Aux Inp test mode | Aux Inp test mode**.
2. At the prompt, select **Yes** to adjust counts.
3. Input the Aux counts that you want to force.
4. At the prompt, select **Yes** to start test mode and send new data.
5. The transmitter continues functioning in auxiliary test mode until it times out after one hour, or until you choose **Exit Aux test mode**.

Exit auxiliary input test mode

Procedure 4.9: Exit Auxiliary test mode

1. From the **Advanced Fxns** menu, select **Test mode | Aux Inp test mode | Exit Aux test mode**.
2. At the prompt, select **Yes** to exit the test mode.

Relay test mode

Use this feature to manually toggle the relay On or Off to test the contacts. This is useful for verifying whether alarm annunciators are functioning.

Start relay test mode

Procedure 4.10: Start Relay test mode

1. From the **Main menu**, select **Advanced Fxns | Test mode | Relay test mode | Enter mA test mode**.
2. At the prompt, select **Energize relay** or **De-energize relay**.

The transmitter continues functioning in Relay test mode until it times out after one hour, or until you choose **Exit relay test**.

Exit relay test mode

Procedure 4.11: Exit Relay test mode

1. From the **Advanced Fxns** menu, select **Test mode | Relay test mode | Exit relay test**.

Temperature test mode

The temperature test mode enables the user to manually force the LSGH sensor temperature probe output to a specified value. This is useful for verifying the scintillator sensor temperature compensation.

Start temperature test mode

Procedure 4.12: Start Temperature test mode

1. From the **Main menu**, select **Advanced Fxns | Test mode | Temperature test mode | Enter Temp. test**.
2. At the prompt, enter the value of the new temperature that you want to force.

   The transmitter continues functioning in Temperature test mode until it times out after one hour, or until you choose **Exit Temp. test mode**.

Exit temperature test mode

Procedure 4.13: Exit Temperature test mode

1. From the **Advanced Fxns** menu, select **Test mode | Temp. test mode | Exit Temp. test mode**.
2. At the prompt, select **Yes** to exit the test mode.

Other advanced functions

The information that displays in the Other Advanced functions is useful for diagnostics. Table 4.5 lists the value name and descriptions.

Table 4.5 Other advanced functions descriptions

Value Name	Description
Sensor voltage	The scintillator sensor voltage
Poll address	The HART poll address of the transmitter. Each transmitter in a current loop must have a unique poll address. This value is meaningful only when multiple transmitters connect on the same loop.
Firmware version	The firmware version on the FLASH
Hardware version	The Hardware version number
CPU serial number	The GEN2000 CPU boards serial number
Sensor serial number	The GEN2000 unit serial number
Temperature coefficients	The algorithm that compensates for variations in measurement output with changes in temperature uses temperature coefficients. The VEGA factory determines the coefficients through rigorous testing. You cannot change these values through normal operation.

Checking the sensor voltage, poll address, version, and serial numbers

Procedure 4.14: Checking equipment version and serial numbers

1. From the **Main menu**, select **Advanced Fxns | Other advanced**.
2. From the **Other advanced** screen, select one of the following:
   - Sensor voltage
   - Poll addr
   - Firmware ver
   - Hardware ver
   - CPU Serial No.
   - Sensor Serial No.
   - View Temp. coefs

Select gauge type

VEGA's nuclear density gauges use much of the hardware and software of the VEGA HART Level transmitters. If your level transmitter indicates PV or Density as the process variable, it was set incorrectly for a level type application. Select gage type enables the users to set the software to operate as either a density or a level gage.

Procedure 4.15: Select gage type

1. From the **Main menu**, select **Advanced Fxns | Select gage type | Level**.
2. If using a HART hand-held communication device, press F2 to send.

Select gauge location

The local gauge refers to a gauge that has its sensor electronics and processing electronics all contained in the same housing. Set a gauge to remote if the sensor electronics and processing electronics are in separate housings and the process signal connects to the auxiliary input of the processing electronics.

Procedure 4.16: Select gage location

1. From the **Main menu**, select **Advanced Fxns | Select Gage Locati**.
2. From the **Select Gage Locati** menu, select either **Local** or **Remote**.
3. If using a HART hand-held communication device, press F2 to send.

CHAPTER

5

DIAGNOSTICS AND REPAIR

Software diagnostics

The level transmitter system can alert users to potential problems by:

- Posting messages on the HART screens
- Energizing the output relay
- Distinctly changing the current loop output
- Tracking the current status and history in the Gauge status screens

Table 5.1 Alarm types

Value Name	Description
Diagnostic alarm	Provides information about the level transmitter system and alerts the user when periodic procedures are due.
Analog alarm	Sets the current loop mA output to either 2mA or 22mA when the detector outputs zero counts.
Process alarm	The process alarm allows the relay output to trip when the process level is either above (high limit) or below (low limit) a setpoint.
X-ray alarm	Distinctly changes the current loop mA output in response to a marked increase in the radiation field. This prevents control problems when external radiographic sources are in the area for vessel inspections.

Table 5.2 Alarm type outputs

Alarm type	Option to trigger relay	Display HART message	Current loop output affected	Gauge status and gauge history
Diagnostic	Yes	Optional	No	Yes
Analog	No	No	Yes	No
Process	Yes	No	No	No
X-ray	Yes	No	Yes	No

Note: See page A-11 for further information about alarm function set up.

Gauge status

Use the **Gauge Status** screens under the Main menu to check status and historical information.

Diagnostic alarms and HART messages

Diagnostic conditions that are currently in alarm alert the user by three possible means:

1. Diagnostics screens in the **Gauge status** menu
2. HART messages that appear when a HART device connects if the diagnostic condition is set to **On** in the **Initial setup** screens
3. Relay output if it is set as a diagnostic alarm relay, and if the diagnostic condition is set to **On** in the **Initial setup** screens

Note: Refer to the table on page 5-4 for a summary of all diagnostic alarm conditions and recommended actions.

Gauge status diagnostics screens

To check the status of the system you can use the **Diagnostics** screen from the **Gauge status** menu to scroll through a series of checks. This screen indicates only the status: historical occurrences are stored in the **Diagnostic history** screens from the **Gauge status**, **View history** menus.

Some conditions are self-repairing, for example RAM and EEPROM corruption. Therefore, these may appear in the history screens but not in the diagnostic screens.

You can view the status of all diagnostic alarms in the **Diagnostics** screen from the **Gauge status** menu.

Acknowledging diagnostic alarms

If a condition is in alarm, you can acknowledge it (turn it off) in the **Diagnostics** screen from the **Gauge status** menu. The following alarms are exceptions to this rule:

- Source wipe due
- Shutter check due
- Standardize due

These exceptions acknowledge when the function performs.

Note: If the relay is set as a diagnostic alarm, you must acknowledge all diagnostic alarms to reset the relay.

Checking and acknowledging the diagnostic alarms with Gauge status

Procedure 5.1: Checking and acknowledging diagnostic alarms

1. From the **Main menu**, select **Gauge status | Diagnostics**.
2. The first diagnostic condition displays. Press F2 to view all the conditions.
3. If a diagnostic condition is in alarm, you can either:
   - Clear the alarm by choosing Acknowledge alarm
   - or ignore the alarm by pressing NEXT.
4. The message, Current Status Complete, displays after viewing all of the conditions.

Diagnostic alarm messages

Active alarm messages may appear on the HART device if the alarm condition is toggled on. You can toggle individual alarm conditions On or Off in the **Diagnostic alarm** screens from the **Initial setup**, **Alarms**, **Mode configuration** menus.

When a HART device initially connects to the level transmitter, any conditions in alarm display on the screen.

Summary of diagnostic alarm conditions

Table 5.3 Diagnostic alarm conditions

Diagnostic check and Normal/Error conditions	HART message Diagnostic description	Recommended action
RAM status–Pass/Fail	RAM corrupt–RAM memory corruption has occurred and has been resolved internally. Repeated triggering of this alarm indicates a possible hardware problem.	Consult VEGA Field Service.
Sensor EEPROM status– Pass/Fail	Sensor EEPROM corrupt–Non-critical memory corruption has occurred on the sensor pre-amp board EEPROM and may not have been resolved internally.	o check if the problem is recurring, after acknowledging the alarm, cycle power to the unit. If alarm occurs again, it indicates a hardware problem. Perform the procedure “Repairing corrupted EEPROM” on page 4-6.
Real time clock test–Pass/Fail	Real time clock fail–The clock has failed. This can cause a miscalculation of timed events. (If the transmitter has not been powered up for more than 28 days, the time and date should be reset.)	Reset the time and date. If the time and date do not reset, call VEGA Field Service.
Sensor temp probe test–Pass/Fail	Sensor temp probe fail–The sensor temperature probe may not be functioning, which results in erroneous measurements.	Verify by checking the sensor temperature on the **Advanced Fxns / Process chain / Primary channel** screen. If the temperature reads -0.5 °C constantly, the probe is broken and the sensor assembly may need to replacement. Call VEGA Field Service.
Standardize due?–No/Yes	Standardize due	Alarm is acknowledged automatically by the system when a process standardize procedure is completed under the **Calibrations /Process stdz** screen.
Source wipe due?–No/Yes	Source wipe due	Alarm is acknowledged by logging a shutter check under **Initial setup / System parameters / Source function** screen. See page 5-14 for details.
CPU EEPROM status–Pass/Fail	CPU EEPROM corrupt–Non-critical memory corruption has occurred on the CPU board EEPROM and may not have been resolved internally.	To check if the problem is recurring, after acknowledging the alarm, cycle power to the unit. If alarm occurs again, it indicates a hardware problem. Perform the procedure “Repairing corrupted EEPROM” on page 4-6.

Table 5.3 Diagnostic alarm conditions (continued)

Diagnostic check and Normal/Error conditions	HART message Diagnostic description	Recommended action
Alarm type 1–Not used	Not used in standard software.	Consult VEGA special software
Alarm type 2–Not used	Not used in standard software.	Consult VEGA special software
Shutter check due?–No/Yes	Shutter check due	Alarm is acknowledged by logging a shutter check under **Initial setup / system parameters / source functions** screen. See page 5-14 for details.
New hardware found?–No/Yes	New hardware found–The CPU board detects a configuration mismatch. The CPU board or sensor assembly may have been replaced, or one of the EEPROM configurations is erroneous.	Refer to page 4-5 for more information.
Sensor status?–Pass/Fail	Sensor fail–Less than one count seen in the last 10 seconds. (Configurable by Field Service.) Indicates the sensor is malfunctioning.	Call VEGA
Process out of range?–No/Yes	Process out of measurement range–The current process value is not within the limits set by the Max level and Min level in the gauge span settings.	Call VEGA
Sensor voltage status–Pass/Fail	Sensor high voltage fail–The high voltage on the PMT is outside the usable range.	Check wiring on CN2. Consult VEGA Field Service.

Analog alarm

If the current loop output (analog output) is stable at either 2mA or 22mA, the analog alarm is set.

The analog alarm is set when the counts from the detector falls below a set threshold, indicating that the detector is not outputting enough counts to make a meaningful measurement. This is, also known as, zero counts.

If the analog alarm is on, check the following:

☑ Source holder shutter is in the On or Open position to create the required radiation field

☑ Extreme build-up on walls or other material shielding the detector from the radiation field

☑ Damage or disconnection of electrical connections from sensor assembly to CPU board.

Process alarm

The process alarm alerts users when the process level is above a setpoint (high limit) or below a setpoint (low limit). Enter the choice of low or high limit and the setpoint in the **Initial setup** screens. See Appendix A: “Initial factory setup” for details.

The process alarm works only with the output relay. No HART messages, gauge status diagnostics, or history information saves for the process alarms.

The level transmitter acknowledges or resets the process alarm when the process value returns back to the setpoint value. Depending on your usage of the process alarm relay, you may want to install a process alarm override switch to manually turn off an annunciator when the level transmitter relay energizes.

X-ray alarm

The x-ray alarm compensates for false indicated process values that occur when the gauge detects external radiographic sources. For example, vessel weld inspections often use portable radiographic (x-ray) sources. X-rays that the gauge detects can cause a false low reading and adversely affect any control based on the gauge output.

The x-ray alarm can perform the following actions:

- Alter the current loop output to indicate the alarm condition
- Trip the output relay, if the relay is set up to do so

The level transmitter enters the x-ray alarm condition when it detects a radiation field above a set threshold. The gauge sets the current loop output at its value 10 seconds before the condition. It periodically dithers the output about the average, cycling until the radiation field is back to the normal level or until a time-out period of 60 minutes.

The standard x-ray alarm only triggers when the counts are greater than the cal low count value. These counts are found on the process variable menu. If the x-ray source is setup so that the counts increase but do not go above the cal low counts, the x-ray alarm does not trigger and the gauge reads the x-ray interference as a true process shift.

Auxiliary x-ray alarm

VEGA has a system that can detect x-rays that are causing process changes. This system places a second detector outside of the radiation beam of the primary detector. The second detector only monitors x-ray interference. The second detector has a frequency output that wires to the auxiliary input of the primary detector. The primary detector's programming triggers the x-ray alarm when the counts of the secondary detector are above a threshold. Contact VEGA for more information about the x-ray interference detection method.

Figure 5.1 illustrates the current loop output. You can set the parameters of the output. Refer to Appendix A: “Initial factory setup”.

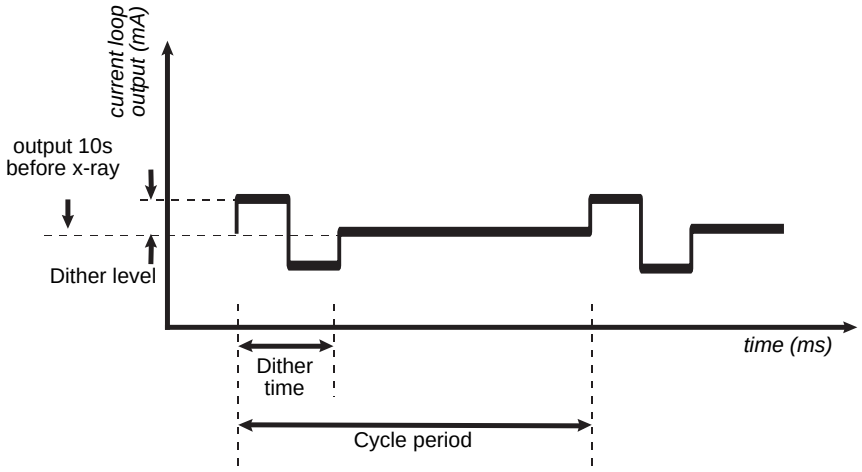


Figure 5.1 X-ray interference alarm output

History information

Information about critical events stores in the **Diagnostic history** screens from the **Gauge status**, **View history** menus. You can view the newest and oldest trigger records of the following events:

- RAM corrupt
- Sensor EEPROM corrupt
- FLASH corrupt
- Real time clock fail
- Sensor temperature fail
- Standardize due
- Source wipe due
- New hardware found
- CPU EEPROM
- Alarm type 1
- Alarm type 2
- Shutter check due
- Sensor fail
- Process out of range
- Sensor voltage out of spec

Use this information to determine if a problem has recently occurred and internally repaired. An example of this would be an EEPROM corruption.

Troubleshooting

There are two circuit boards in the LSGH that are field replaceable.

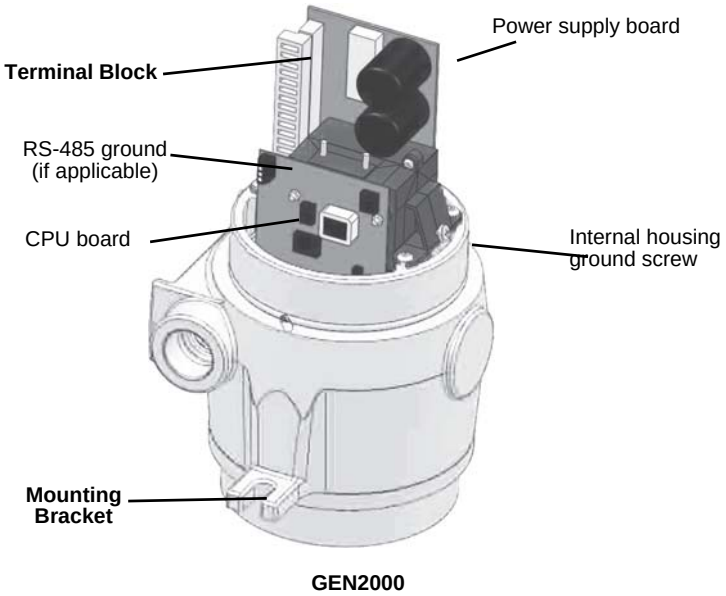


Figure 5.2 Circuit board identifications

Refer to Figure 5.3 for help in finding test points, fuses, jumpers, and connectors on the CPU circuit board.

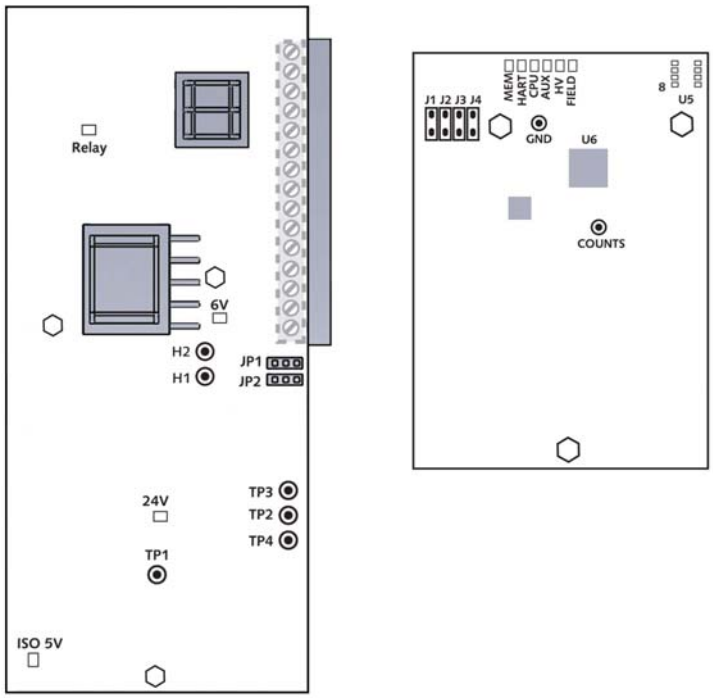


Figure 5.3 Power supply and CPU board – simplified component layout

Test points

Test points are located on the power supply and CPU board. Table 5.4 lists and describes the power supply board test point labels.

Table 5.4 Power supply board test point labels and descriptions

Power supply board test point label	Description
H1	HART connection
H2	HART connection
TP1	Isolated ground
TP2	Loop current test point 200mV/mA loop current. Referenced to isolated ground

Table 5.5 lists and describes the CPU test point labels.

Table 5.5 CPU test point labels and descriptions

CPU test point label	Description
Count	Raw input signal coming from preamp.
GND	Logic ground
U5 pin 8	+5V power supply test points referenced to Logic ground

Jumpers

Jumpers JP1 and JP2 on the power supply board set the current loop source or sink mode. Do not change the jumpers from the current setting without consulting VEGA Field Service.

The jumpers for the current loop power source or sink mode are set as follows:

Table 5.6 Jumper settings

Mode	Jumper setting
Source mode (LSGH current loop is self-powered)	JP1 1-2, JP2 2-3
Sink mode (LSGH current loop is DCS-powered)	JP1 2-3, JP2 1-2

The LSGH does not use jumpers J1-J4 on the CPU board.

LED indicators

Check the basic functioning of the LSGH at the instrument with LED indicators on the CPU board. They are visible when you remove the explosion-proof housing pipe cap.

See the Tables on page 5-12 and page 5-13 for the summary of the LED indications. Figure 5.4 illustrates the LED indicators.

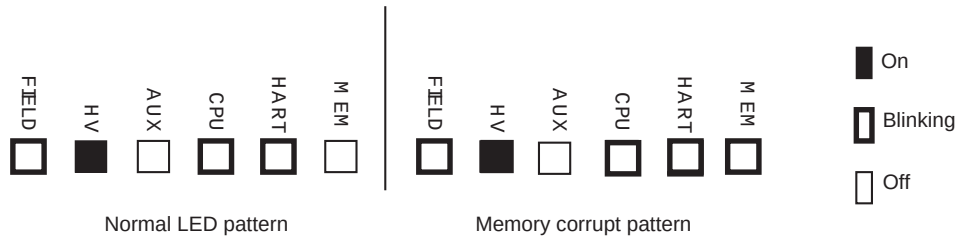


Figure 5.4 LED indicators

FLASH corrupt LED pattern

The FLASH chip stores the device description (DD) software. The transmitter does not operate if the FLASH chip is corrupt. When this occurs, the HART device that connects to the transmitter displays the message, No Device Found. In this situation, the LED bank displays a distinctive pattern shown in Figure 5.4. Call VEGA Field service to report this condition.

Table 5.7 Power supply board LED summary

Power Supply Board LED summary table				
LED	**Description**	**Normal condition**	**Error condition**	**Recommendation**
+6V	+6V DC voltage level to electronics	ON	OFF – electronics are not receiving +6V DC voltage required for functioning.	Verify +6V on test points. Check fuse on Power Supply board. Check power input terminals 1, 2.
+24V	Analog output loop voltage	ON	OFF – 24V not present on 4 ... 20 mA output. 4 ... 20 mA output and HART communications are bad.	Check loop wiring and jumpers JP1, JP2 on Power Supply board. Replace Power Supply board.
Relay	Relay condition indicator	ON when relay is energized. OFF when relay is de-energized.	None	Check against relay output terminals 3, 4, & 5. If no relay output, replace Power Supply board.

Table 5.8 CPU board LED summary

CPU Board LED summary table				
LED	**Description**	**Normal condition**	**Error condition**	**Recommendation**
Mem	Memory corruption (EEPROMs and FLASH)	OFF	1 blink: CPU EEPROM corrupt 2 blinks: Sensor EEPROM corrupt 3 blinks: Both EEPROMs corrupt 4 blinks: RAM corrupt 5 blinks: Memory mismatch ON solid: combination of errors	Check software diagnostics. Call VEGA Field Service.
HART	HART communicati on indicator	ON – blinks when receiving HART messages	None	Check HART device connection on loop and HART device functioning.
CPU	Central processing unit on CPU board “heartbeat”	Blinks at rate of 1 time per second	LED does not blink. CPU not functioning.	Check power input. Replace CPU board.
Aux	Auxiliary input frequency signal indicator	Blinks if auxiliary input present. OFF if no auxiliary input present	None	Check auxiliary input wiring terminals 11 and 12 with a meter for frequency signal. Check auxiliary input equipment.
HV	Sensor high voltage	ON – high voltage is in spec	OFF – high voltage is out of spec	Call VEGA Field Service
Field	Radiation field indicator	Cycles in proportion to radiation field intensity at detector. ON for 10 seconds for each mR/hr, then off for two seconds. (Can use LED 5 that blinks 1 time/sec to time LED1 for field indicator.)	None	A 1mR/hr (2,580nC/kg/hr) field is usually required for a measurement. Check for closed source shutter, buildup, and insulation.

Maintenance and repair

Periodic maintenance schedule

Since the VEGA level transmitter contains no moving parts, very little periodic maintenance is required. We suggest the following schedule to prevent problems and to comply with radiation regulations:

Table 5.9 Periodic maintenance schedule

Description	Frequency	Procedure
Standardize	As required by process conditions, usually at least once a month	"Calibration" chapter
Source holder shutter check	Every six months unless otherwise required by applicable nuclear regulatory agency	Radiation safety instructions shipped separately with source holder and following instructions
Source wipe	Every three years unless otherwise required by applicable nuclear regulatory agency	Radiation safety instructions shipped separately with source holder and following instructions

Source wipe and shutter check recording

The VEGA level transmitter can automatically remind users when a source wipe and shutter check are due, using the diagnostic alarms. If you use this feature, you must record the source wipes and shutter checks in the software to acknowledge the alarm and to reset the timer.

Perform the following procedure after a source wipe or a shutter check.

Refer to the *Radiation Safety for U.S. General and Specific Licensees, Canadian and International Users* Manual 239291, *Radiation Safety Manual Addendum of Reference Information* CD 244316, and the *Model SHGL Addendum to the Radiation Safety Manual* 244589 (if applicable) that came with the source holder and the appropriate current regulations for details.

Recording a source wipe or shutter check

Procedure 5.2: Recording a source wipe or shutter check

1. From the **Main menu**, select **Initial setup|System parameters|Source function**.
2. From the **Source function** menu, select **Record wipe**, or select **Record shut chk**.
3. At the prompt, select **Yes** to start recording.

Check when the next source wipe or shutter check is due

Procedure 5.3: Check due date of source wipe or shutter check

1. From the **Main menu**, select **Initial setup | System parameters | Source function | Next wipe/shut due**.
2. From the **Next wipe/shut due** menu, select either **Next wipe due** or **Next shut chk due** to view the due date.
3. Press F2 to exit.

Spare parts

Contact VEGA Field Service at +1 513-272-0131 for parts, service, and repairs.

Outside the U.S., contact your local VEGA representative for parts, service, and repairs.

Field repair procedures

Very few parts are field repairable, but you can replace entire assemblies or boards. The following parts are replaceable:

- CPU circuit board
- Power supply circuit board

Note: Prevent damage to the electrical components of the gauge using the appropriate electrostatic discharge procedures.

Replacing the CPU or Power supply board

You may have to replace a circuit board if there is damage to one of its components. Before replacing a circuit board, check the troubleshooting flowcharts or call VEGA Field Service to be sure a replacement is necessary.

The sensor EEPROM contains a backup of the CPU board EEPROM. After physically replacing the CPU board, you must perform a memory backup to update the CPU board EEPROM with the information in the sensor board EEPROM. Perform the memory back up in the **New hardware** screen, from the **Advanced Fxns** menu.

Replacing the CPU or power supply board

You may have to replace a circuit board if there is damage to one of its components. Before replacing a circuit board, check the troubleshooting flowcharts or call VEGA Field Service to be sure a replacement is necessary.

The sensor EEPROM contains a backup of the CPU board EEPROM. After replacing the CPU board, you must perform a memory backup to update the CPU board's EEPROM with the information in the sensor board EEPROM.

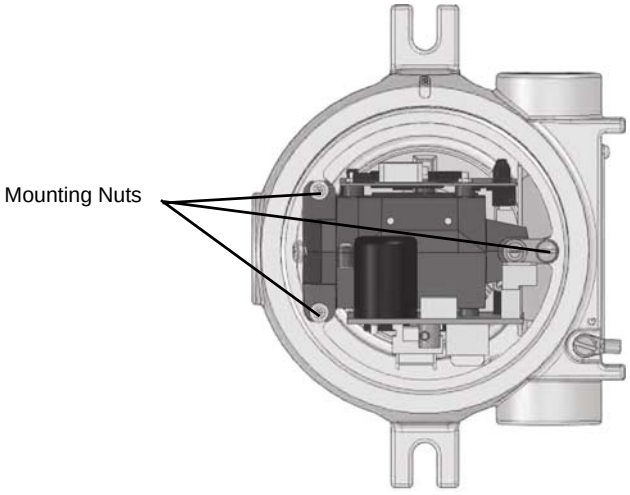
Procedure 5.4: To replace the CPU or power supply board

1. Shut off the power to the gauge.
2. Remove the housing cover.
3. Remove the plastic electronics cover.
4. Remove the terminal wiring connector.
5. Remove the three (3) screws holding the electronics package in place.
6. Carefully pull the electronics package out of the housing.
7. Remove the appropriate board from the clamshell assembly by removing the three (3) mounting nuts.

Note: If you are changing the CPU board, you must move the old firmware chip to the new board if the new board firmware is different.

8. Carefully reconnect any ribbon cables.
9. Install the electronics package in the housing.
10. Replace the three (3) mounting nuts.
11. Reconnect the terminal wiring connector.
12. Install the plastic electronics cover.
13. Install the housing cover.
14. Turn on the power to the unit.
15. Connect a HART communicator to the unit and verify that the unit is operational.

Note: If you change the CPU board, a New Hardware Found error message appears when you connect with the HART communicator. In Ohmview 2000, click Diagnostics, New hardware, New CPU, and click OK for a new backup of EEPROMS.



Replace Power Supply or CPU Board

Requesting field service

To request field service within the U.S. and Canada; call 513-272-0131 from 8:00 A.M. to 5:00 P.M. EST Monday through Friday. For emergency service after hours, call 513-272-0131 and follow the voice mail instructions.

Returning equipment for repair to VEGA

When calling VEGA to arrange repair service, have the following information available:

- ☑ Product model that is being returned for repair
- ☑ Description of the problem
- ☑ VEGA Customer Order (C.O.) Number
- ☑ Purchase order number for the repair service
- ☑ Shipping address
- ☑ Billing address
- ☑ Date needed
- ☑ Method of shipment
- ☑ Tax information

Returning equipment for repair

Procedure 5.5: Returning equipment for repair

1. Call VEGA Nuclear Products Repair at 513-272-0131 between Monday and Friday, 8:00 A.M. to 5:00 P.M. United States Eastern Standard Time.
2. VEGA assigns the job a material return authorization (MRA) number.

   Note: VEGA reserves the right to refuse any shipment that does not have a MRA number assignment.

3. Indicate the MRA on the repair service purchase order.
4. Clearly mark the shipping package with the MRA number.
5. Send the confirming purchase order and the equipment to:

   VEGA Americas, Inc.
   Attention: Repair Department
   4170 Rosslyn Drive
   Cincinnati, OH 45209-1599 USA

   Note: You must first contact VEGA and receive a material return authorization number (MRA) before returning any equipment to VEGA. VEGA reserves the right to refuse any shipment not marked with the MRA number.

APPENDIX

A

INITIAL FACTORY SETUP

Perform all setup functions from the Initial setup menu. These functions include the following:

- Process parameters
  - Units
  - Calibration parameters
- System parameters
  - Time and date
  - Source type
  - Source function
  - System information
- Alarms
  - Dianostic
  - Analog
  - Process
  - X-Ray
- Auxiliary inputs
  - Input filter
- Spans setup

Note: Perform setup before the initial calibration, since some parameters are necessary for calibration.

Process parameters

Units

Level units

The following engineering units are available for a level measurement:

- In – inches
- ft – feet
- cm – centimeters
- mm – millimeters
- m – meters
- % – percent
- Spcl – special (used in conjunction with Custom units, below)

Custom units

You can program a custom unit if the unit you require is not in the standard list. Choose the unit **Spcl** (Special) from the **Units** screen. Enter the numeric conversion factor in the form:

x custom units / inch

Setting the process units

Procedure A.1: Setting the process units

1. From the **Main menu**, select **Initial setup | Process parameters | Process units | Level units**.
2. From the **Level units** screen, scroll through the list and choose the correct level unit for your process by pressing F2 to enter. You will need to enter a custom unit if the unit you want is not in the list. See the procedure for setting custom units in this section.
3. After selecting the units, press F2 to send the information to the transmitter. This ensures that other setup and calibration functions you perform use the desired engineering units.

Setting custom units

Procedure A.2: Setting custom units

1. From the **Main menu**, select **Initial setup | Process parameters | Process units | Custom units**.
2. From the **Custom units** screen, select **Conversion to length**.
3. Enter the conversion factor in factor in custom units per inch.
4. Press **F2** to enter.
5. Press the LEFT ARROW to move back to the **Process units** menu.
6. From the **Process units** menu, select **Level units**.
7. In the **Level units** screen, select **Spcl** as the units.
8. If using a hand-held HART Communicator, press F2 to send the units to the transmitter. This ensures that other setup and calibration functions use the correct engineering units.

Calibration parameters

Table A.1 Calibration parameters and descriptions

Value Name	Description
Data coll interval	The time in seconds over which the system collects a process measurement. Use this interval time to collect data for: • Initial calibration • Linearizer curve • Standardization
Warn % span cal	The difference between the two initial calibration points (cal low level and cal high level) as a percent of level span that causes a warning to appear. For a good calibration, it is important for the two initial calibration points to be as far apart as possible. The default value is 10%. The user typically does not need to change this value for most applications.
Process stdz type	Determines how you enter the actual process value of a standardize sample. If this is set as Use Lab sample value, the software screens prompt entry of the sample value during a standardize. If this is set as Use Default value, the software always uses the Default standardize level as the sample value.
Default std	The default level value in engineering units that you use in the standardization procedure. At standardization, enter the actual level of the process material to override this default.
Stdz interval	The intervals in days between standardize alarms. The level transmitter alarms to indicate that a standardize procedure is due if the diagnostic alarm, Standardize due, is toggled on.

Setting the calibration parameters

Procedure A.3: Setting the calibration parameters

1. From the **Main menu**, select **Initial setup | Process parameters | Cal parameters**.
2. From the **Cal parameters** menu, select the calibration parameters to view or edit, as needed. Refer to the help screens (F1) or page A-3 in this manual for descriptions. View or edit the following parameters:
   - Data coll interval
   - Warn % cal span
   - Process stdz type
   - Default std
   - Stdz interval
3. If using a hand-held HART Communicator, press F2 to send the updated calibration parameters to the transmitter.

Filtering

This feature enables change to the response time of the system by increasing or decreasing the averaging time that is used to filter the noise in the signal. An increased time for averaging enables the accumulation of a greater number of readings and therefore produces a greater statistical accuracy. However, this is at the expense of response time to changes in the process.

Type (RC exponential or rectangular window)

The level transmitter offers a choice of signal filters, RC exponential or rectangular window. The level transmitter has a sample rate of about 1 sample/second, but process variables generally change measurably on the order of minutes. Electrical and source noise occur on the order of seconds, so they can be filtered out with a low pass filter, leaving only the change in the process variable in the signal.

RC exponential

RC exponential filtering simulates the traditional Resistance/Capacitance filtering. It provides an infinite impulse, in which all of the previous samples contribute less and less to the average, but all contribute somewhat. The most recent samples are weighted most heavily in computing the average. Compared to rectangular window filtering, RC exponential filtering provides a quicker response to step changes in the process but has a larger noise band.

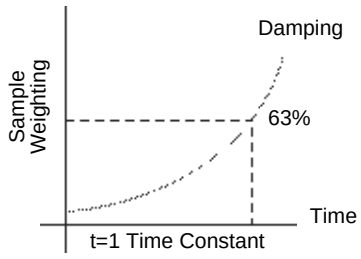


Figure A.1 RC exponential filtering

Rectangular window filtering

Rectangular window filtering computes an average based only on a specified (finite) number of samples. All samples are weighted equally in the average. Although it provides a slower step response (since the most recent measurements are weighted the same as those further back in time), it produces a less noisy signal. Generally, rectangular window linear averaging by itself produces results similar to combining RC exponential filtering with the fast cutoff feature.

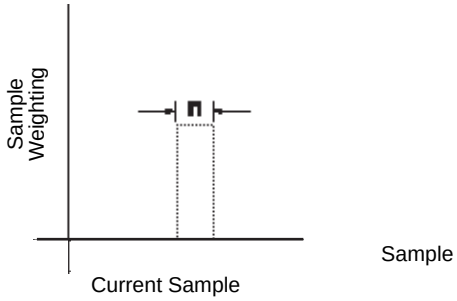


Figure A.2 Rectangular window filtering

Damping

The type of filter you choose determines the damping function.

With the RC exponential method, the damping entry is equivalent to a time constant, that is, the amount of time (in seconds) that it takes for the gauge reading to achieve 63.2% of a step change in process. A range of integer values from 1-600 seconds is possible for this time constant entry.

With the rectangular window filtering, the damping entry determines how many samples to use when calculating the average, responding to 100% of a process step change. The maximum damping entry is 100 with this type of filtering.

Fast response cutoff

Fast response cutoff temporarily bypasses the RC or digital filtering when the change in process exceeds this value (in engineering units) between successive samples. This enables the level transmitter to respond immediately to large step changes while filtering the smaller variations in the signal caused by noise and normal process variations. To turn off the fast cutoff filter, set the value to zero.

Selecting a filter type, damping, and fast cutoff

Procedure A.4: Selecting a filter type, damping, and fast cutoff

1. From the **Main menu**, select **Initial setup | Process parameters | Filtering | Filter type**.
2. On the **Filter type** screen, the currently used filter type displays as either RC Exp Filter or Rect Window Filter. To change the filter type, select either **RC Exp Filter** or **Rect Window Filter**. Press F2 to enter.
3. From the **Filtering** menu, select **Damping**.
4. From the **Damping** screen, enter the damping desired and F2 to enter. Refer to the help screens (F1) or page A-6 in this manual for details.
5. From the **Filtering** menu, select **Fast cutoff**.
6. From the **Fast cutoff** screen, enter the cutoff value desired and press F2 to enter. Refer to the help screens (F1) or page A-6 in this manual for details.

   Note: To turn off Fast cutoff, enter 0 as the value.

7. If using a hand-held HART Communicator, press F2 to send the updated filtering parameters to the transmitter.

Span settings

The spans for the process, current loop, and any optional auxiliary input are set in the **Spans** screen from the **Initial setup**, **Process parameters** menus.

Process span

Process span **is** the anticipated lowest and highest level (Min and Max level) measurement with the gauge. The level transmitter calibrates within these settings. These define the endpoints for the calibration and linearizer curve. This does not define the span for the output current loop. Refer to the “Setting the current loop span” procedure in this section.

Note: The Min and Max Level values for the process span are essential to proper calibration of the system. You must enter the Min and Max level for process span before you perform an initial calibration. You must perform a new initial calibration procedure if the values for the process span Min or Max levels change.

Modify the span setting if the level transmitter moves from its intended location, or is measuring on a different span. It is a good practice to verify that the setting is correct before performing an initial calibration.

Setting process span

Procedure A.5: Setting the process span

1. From the **Main menu**, select **Initial setup | Process parameters | Spans | Process span**.
2. From the **Process span** screen, set both the minimum and maximum values for the measurement span.
3. Press F2 to send the setting to the transmitter.

Current loop span

The current loop output can be set to be either “forward acting” or “reverse acting” by choosing the appropriate values of 4 mA Level and 20 mA Level. A forward acting output is proportional to the level and a reverse acting output is inversely proportional to the level. See Table A.2 for an example of settings for process values of 0% and 100%:

The current loop span is the lowest and highest level to be indicated by the 4 ... 20 mA current loop (analog output). These settings do not have to be the same as the process

span settings (Min level and Max level), but must be within the boundaries set for the process span. The screens prompt entry of a 4 mA level and a 20 mA level.

Table A.2 Setting process values of 0% and 100%

Forward acting (proportional)		Reverse acting (inversely proportional)	
4 mA Level	**20 mA Level**	**4 mA Level**	**20 mA Level**
0%	100%	100%	0%

Procedure A.6: Setting the current loop span

1. From the **Main menu**, select **Initial setup | Process parameters | Spans | Current loop span | 4 mA Level**.
2. In the **4 mA Level** screen, enter the minimum value for the measurement span.
3. From the **Current loop span** menu, select **20 mA Level**.
4. In the **20 mA Level** screen, enter the maximum value for the measurement span.
5. **Press F2 to send the setting to the transmitter.**

System parameters

The system parameters define settings for the internal operation of the level transmitter and the radiation source.

Time

Current time in HH:MM:SS as set in the real time clock. The time maintains during power failure for up to 28 days. It is important to enter the correct time and date, because they are used for several internal calculations. Time reverts to 00:00:00 on clock failure.

Date

Current date in MM/DD/YY (month, day, year) format. The date reverts to 00/00/00 on failure.

Setting the time and date

Procedure A.7: Setting the time and date

1. From the **Main menu**, select **Initial setup | System parameters | Time and Date**.
2. From the **Time and Date** menu, select **Time**.
   - Enter the current time.
   - Press F2 to save the time setting.
   - Press the LEFT ARROW key to return to the previous **Time and Date** screen.
3. From the **Time and Date** screen, select **Date**.
   - Enter the current **Date**.
   - Press F2 to save the date setting.
4. If using a hand-held HART Communicator, press F2 to send the updated parameters to the transmitter.

Source type

Use the Source type feature to view or enter the isotope in the source holder that produces the radiation signal. The VEGA factory enters this parameter based on information received at the time of the order. You can check the isotope type against the source holder label.

Procedure A.8: Setting the source type

1. From the **Main menu**, select **Initial setup | System parameters | Source type**.
2. In the **Source type** screen, select one of the following source types:
   - Cs 137
   - Co 60
   - Am 241
   - Cf 252
   - No source
3. Press F2 to enter.
4. If using a hand-held HART communicator, press F2 to send the updated parameters to the transmitter.

Source function

Wipe Interval

Use the Wipe interval feature to view or enter the interval in days between successive source wipe diagnostic alarms. Check with current applicable regulations.

Record wipe

Use the Record wipe feature to record the date and time when you perform a source wipe. This resets the diagnostic alarm “source wipe due.” For more information, see the “Diagnostics and repair” chapter.

Shut chk Interval

Use the Shutter check interval feature to enter the number of days between successive shutter check diagnostic alarms. Check with current applicable regulations for recommendations on shutter check intervals.

Record shut chk

Use the Record shutter check feature to record the date and time when you perform a shutter check. This resets the diagnostic alarm “shutter check due.” For more information, see the “Diagnostics and repair” chapter.

Next wipe/Shut due

Use the Next wipe and Shutter check due features to view or enter the due date for the next source wipe and shutter check. For more information, see the “Diagnostics and repair” chapter.

Tag

The tag is a unique eight-digit identifier for instrument. If provided at the time of your order, this parameter is entered at VEGA factory prior to shipment. Otherwise, you can enter it on this screen.

Setting the tag identifier

Procedure A.9: Setting the tag identifier

1. From the **Main menu**, select **Initial setup | System parameters | Tag**.
2. In the **Tag** screen, enter the eight digit identifier for the instrument.
3. Press F2 to enter.
4. Press F2 to send the updated parameters to the transmitter.

System information

Message

Use this text field to record information or messages. For example, this is where you can record a message to operators or notes about the gauge.

Procedure A.10: Setting the system information message

1. From the **Main menu**, select **Initial setup | System parameters | System info | Message**.
2. In the **Message** screen, enter messages or notes for the operator.
3. Press F2 to enter.
4. If using a hand-held HART communicator, press F2 to send the updated parameters to the transmitter.

Descriptor

This is a shorter message field to record information or messages.

Procedure A.11: Setting the descriptor

1. From the **Main menu**, select **Initial setup | System parameters | System info | Descriptor**.
2. In the **Descriptor** screen, enter a short message or note for the operator.
3. Press F2 to save.
4. If using a hand-held HART Communicator, press F2 to send the updated parameters to the transmitter.

Setting up alarms

Four types of alarms are available:

1. Diagnostic
2. Analog
3. Process
4. X-ray

The “Diagnostics and repair” chapter thoroughly explains use and acknowledgement of alarms. When you set up alarms, the following options are available:

- Which alarm type triggers the output relay

- Which diagnostic messages appears on the HART display screens
- The output level of the analog alarm
- Specialized parameters of the x-ray alarm

Diagnostic alarm setup

Diagnostic alarms give information about the condition of the level transmitter and can provide reminders to perform periodic maintenance procedures. The reminders appear as messages on the HART screens, when a HART device connects to the level transmitter. In addition, if the level transmitter relay is set as a diagnostic alarm, the condition trips the relay on.

In the setup, there is a list of every diagnostic alarm condition that can toggle On or Off. If the condition flag is Off, that condition does not cause the diagnostic alarm relay to trigger and no HART message appears. The following table lists the available diagnostic alarms conditions. See the “Diagnostics and repair” chapter, page 5-1 for more details.

Table A.3 Diagnostic alarm conditions

RAM corrupt	Standardize due	CPU EEPROM corrupt
Sensor EEPROM corrupt	Source wipe due	Alarm Type 1
Flash corrupt	New hardware found	Alarm Type 2
Real time clock	Sensor fail	Shutter check due
Sensor temp	Sensor high voltage fail	Process out of measurement range

Setting the diagnostic alarm conditions

Procedure A.12: Setting the relay as a diagnostic alarm

1. From the **Main menu**, select **Initial setup | Alarms | Mode configuration | Diagnstic alarm**.
2. If using a hand-held HART communicator, from the **Diagnstic alarm** menu, select **Diagnstic Gp1** (Diagnostic Group 1). If using VEGA View or Ohmview 2000, proceed to the next step.
3. From the **Diagnstic Gp1** screen, scroll through the list of diagnostic conditions that can be used to activate the relay.
   - Toggle the conditions **On** or **Off** with the F2 key.
   - Press F2 to enter.
   - Press the LEFT ARROW key to return to the **Diagnstic alarm** screen.
4. If using a hand-held HART Communicator, from the **Diagnstic alarm** menu, select **Diagnstic Gp2** (Diagnostic Group 2).

5. From the select **Diagnstic Gp2** screen, scroll through the list of diagnostic conditions and toggle the conditions **On** or **Off**.
6. If using a hand-held HART communicator, press F2 to send the setting to the transmitter.

Setting the relay as a diagnostic alarm

Procedure A.13: Setting the diagnostic alarm conditions

1. From the **Main menu**, select **Initial setup | Alarms | Set relay function**.
2. From the **Set relay function** menu, select **Diagnstic** and press F2 to enter.
3. If using a hand-held HART communicator, press F2 to send the setting to the transmitter.

Analog alarm setup

The analog alarm uses the current loop analog output to signify that the sensor is outputting zero counts. In this case, the analog output sets to either 2mA or 22mA, and no longer tracks the process level.

The user can choose the 2mA or the 22mA setting for the analog alarm.

Table A.4 Analog alarm conditions

Alarm out 22mA	Alarm out 2mA

Setting the analog alarm output

Procedure A.14: Setting the analog alarm output

1. From the **Main menu**, select **Initial setup | Alarms | Mode configuration | Analog alarm | Alarm output**.
2. From the **Alarm output** menu, select either **22mA** or **2mA**.
3. Press **F2** to enter.
4. If using a hand-held HART communicator, press **F2** to send the change to the transmitter.

Process alarm setup

Use the process alarm setup to make the relay output a high or low process alarm. For a low limit, a process level below a set point energizes the relay; for a high limit, a process level above a set point energizes the relay.

Process alarms only work in conjunction with the output relay. No HART messages post that relate to the process alarm.

You cannot use a relay as a diagnostic or x-ray alarm if you have set it as a process alarm.

Table A.5 Process relay set alarm conditions

Relay action limit-High limit	Relay action limit-Low limit	Relay setpoint %

Setting up the process alarm

Procedure A.15: Setting up the process alarm

1. From the **Main menu**, select **Initial setup | Alarms | Set relay function**.
2. From **Set relay function** menu, select **Process** and press F2 to enter.
3. Press the LEFT ARROW key to return to the **Alarms** menu.
4. From the **Alarms** menu, select **Mode configuration | Process relay set | Relay action**.
5. From the **Relay action** screen, select either **High limit** or **Low limit**.
6. From the **Process relay set** menu, select **Relay setpoint**.
7. From the **Relay setpoint** screen, enter the numeric value of the alarm setpoint in process units and press F2 to enter when finished entering the value.
8. If using a hand-held HART communicator, press **F2** to send the setting to the transmitter.

X-ray alarm setup

The x-ray alarm compensates for false indicated process values that occur when external radiographic sources the gauge detects. Vessel weld inspections often use portable radiographic sources. Detection of x-rays by the gauge causes a false low reading and adversely affects any control based on the gauge output.

The x-ray alarm distinctly changes the current loop mA output in response to a marked increase in radiation field. It can also trigger the output relay, if set up to do so.

When the gauge detects a radiation field above a set threshold (as a percentage of the cal low counts value), it sets the current loop output at its value 10 seconds before the detection of the x-ray interference. It periodically dithers the output about the average, cycling until the radiation field is back to the normal level or until a time-out period of 60 minutes. See the following figure for a diagram of the current loop output in x-ray interference mode.

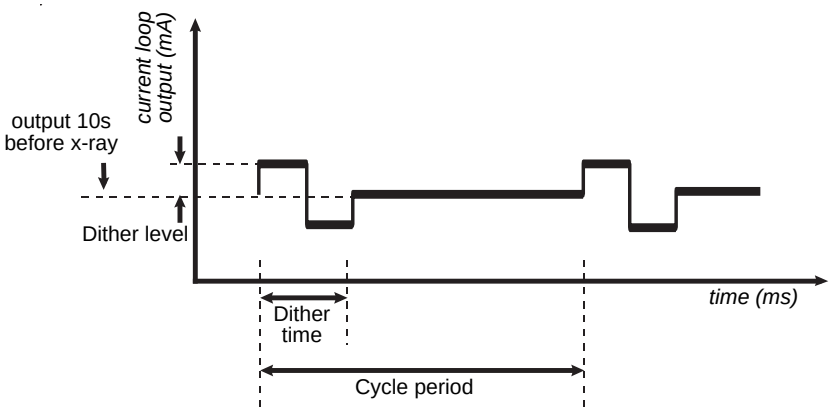


Figure A.3 X-ray interference alarm output

Note: Only VEGA Field Service can adjust the time-out period of 60 minutes and the reversion to 10 seconds before the x-ray detection.

Table A.6 X-ray parameters and descriptions

Value Name	Description
Threshold	The percentage beyond the calibration low counts that triggers x-ray interference suppression. Default value: 1%
Dither level	The magnitude in mA above and below the average output of the current loop dithering. Default value: 1mA
Cycle period	The repetition rate for presenting the current loop dither in x-ray interference output mode. Default value: 1s.
Dither time	The percentage of the cycle period to output the dither. Default value: 1%.

Setting up the x-ray alarm parameters

Procedure A.16: Setting up the x-ray alarm parameters

1. From the **Main menu**, select **Initial setup | Alarms | Mode configuration | Xray alarm**.
2. Edit the following values as necessary:
   - Threshold
   - Dither level
   - Cycle period
   - Dither time
3. If using a hand-held Communicator, press **F2** to send changes to the transmitter.

Setting the relay as an x-ray alarm

Procedure A.17: Setting the relay as an x-ray alarm

1. From the **Main menu**, select **Initial setup| Alarms | Set relay function | X-ray**.
2. Press **F2** to enter.
3. If using a hand-held HART Communicator, press **F2** to send the setting to the transmitter.

Auxiliary input settings

The auxiliary input is an option for the HART level transmitter to receive a frequency signal. With special software, the frequency signal incorporates into the final output.

The software provides special settings for three typical uses of a frequency input:

- Summation mode
- NORM compensation
- Vapor pressure compensation

Note: Refer to Appendix B: “Special applications” for complete application information on using the following compensation methods:

- Summation
- NORM
- Vapor pressure

Input filter

Input filter is the auxiliary input signal with application of the time constant. The filter type (RC or rectangular window) applied to the auxiliary input is the same as the primary channel.

Setting the auxiliary input filter

Procedure A.18: Setting the input filter

1. From the **Main menu**, select **Auxiliary input | Filter TC**.
2. In the **Filter TC** screen, input the value for the filter time constant.
3. Press **F2** to enter.
4. If using a hand-held HART Communicator, press **F2** to send the setting to the transmitter.

Summation mode

The HART level transmitter can have as an input a raw sensor output from another slave level gauge (which cannot be used in the HART current loop). The master level transmitter receiving the input uses the incoming signal to modify its output. For example, you may use this feature to make the master HART level transmitter read the sum of two level gauges.

Note: Refer to “Setting up summation mode” page B-6, for complete application information on using summation mode for multiple level detectors.

APPENDIX

B

SPECIAL APPLICATIONS

This chapter provides application specific information for special installations.

If your application is not in this chapter, you may find application specific information on the certified drawings provided by VEGA or the engineering contractor. If you have other application questions, contact VEGA Field Service in the U.S. or Canada at 513-272-0131 or your local rep outside of the U.S. or Canada.

Note: To use the compensation features of the HART gauge, you must be using VEGA View 2.0 (or higher), Ohmview 2000, or have a HART hand-held communicator programmed with the VEGA COMP device description.

Multiple detectors summation

Some applications require a measurement length longer than the maximum level transmitter detector length.

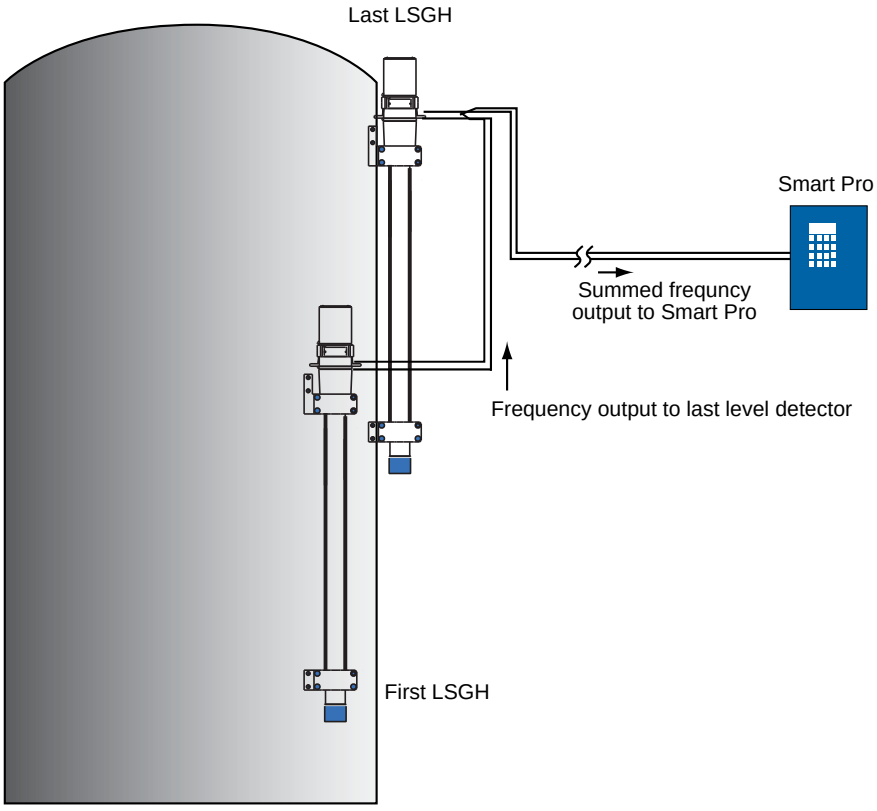


Figure B.1 Multiple detectors summation

Special drawings from VEGA

Identification of applications that require multiple detectors occurs at the time of order. The end user or engineering contractor (or both) receive certified drawings for the exact equipment ordered. Refer to the drawings along with this section of the manual.

Note: If the instructions on the drawings and this manual differ, follow the drawing instructions. They will be specific to your order.

Notes on the frequency output detector

You may not receive a separate manual for the detector that provides the frequency output for the HART level transmitter, especially if ordered as part of a complete system that included a HART level transmitter. The certified drawings and this manual section have sufficient information, in most cases.

Some special notes about the frequency output detector are below:

- Model LSGF uses much of the same hardware as the model LSGH (the HART level transmitter model). They look similar, so verify that you are installing the correct detector as the frequency output slave detector.
- Model LSGF uses a different version of firmware than LSGH. This firmware enables a frequency output instead of the HART output.
- Some spare parts are unique to the frequency output models. See the following tables for the spare part descriptions and part numbers.

LSGF spare parts

Table B.1 LSGF spare parts

Description	VEGA part number
Power supply board	241519
LSGF CPU board	242281
125 mA fuse on power supply board	238661
2.0A fuse on power supply board	240539

Installation requirements

A multiple detector application consists of one HART level transmitter and one (or more) level gauges that output a frequency to the HART transmitter. Follow these installation guidelines:

- Install the detector with the HART output (model LSGH) at the top of the vessel. Install the other detector(s) beneath the HART detector.
- The mounting tabs of the detectors define the active, or sensing, length. Offset the detectors vertically so that the end of the top detector's active length corresponds to the beginning of the bottom detector's active length.
- Place all detectors in the radiation beam.

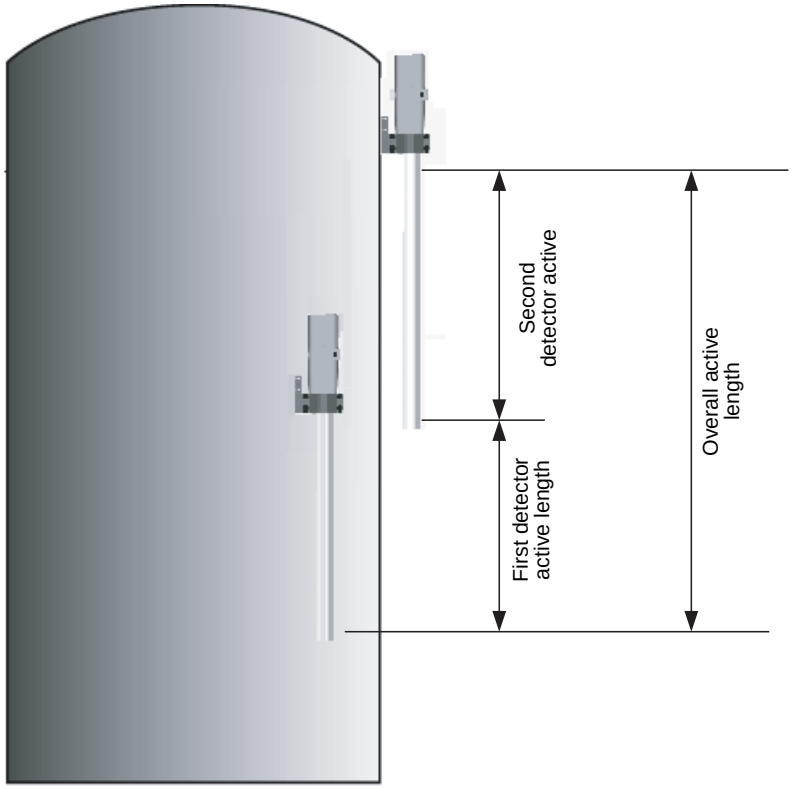


Figure B.2 Placement of multiple detectors

Detector wiring

Multiple detectors application require (at least) one frequency output detector and only one HART output detector.

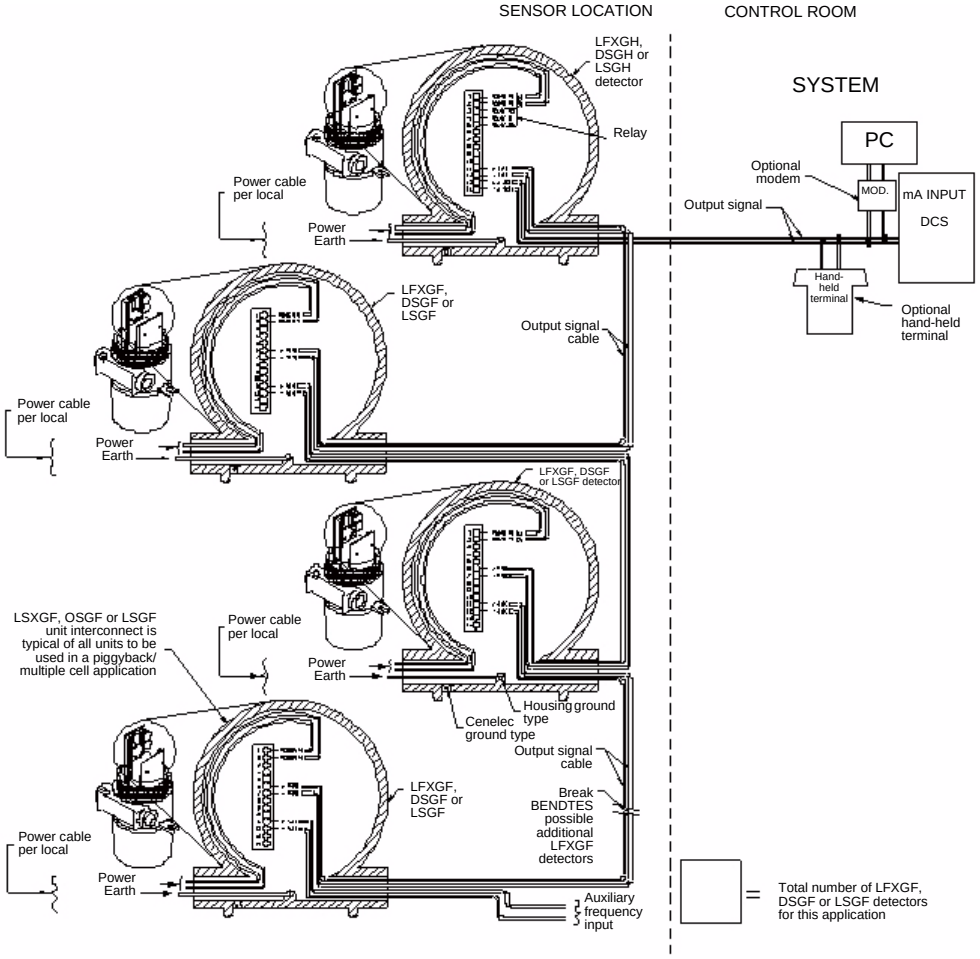


Figure B.3 Interconnect – Multiple detector

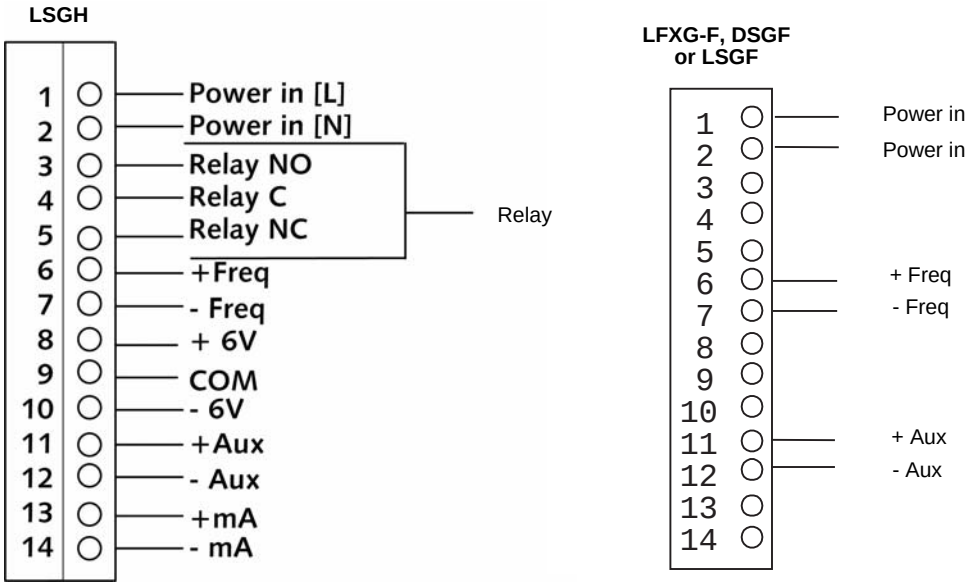


Figure B.4 Multiple detector interconnect terminals

Initial settings and calibration requirements

Refer to these sections of this manual for more details:

Table B.2 Initial setting and calibration locations

Setting	Manual heading	Page
Select Summation mode in Initial setup	Setting up summation mode	B-6
Set span for total of all detectors	Span settings	A-7
Calibrate according to guidelines in calibration chapter	Initial process calibration	3-3

Setting up summation mode

Procedure B.1: Setting up summation mode

1. From the **Main menu**, select **Initial setup | Auxiliary input | Compensation | Type | Summation**.
2. Press F4 to enter.
3. If using a hand-held HART communicator, press F2 to send the settings to the transmitter.

Calibrating with multiple detectors summation

The calibration procedures are the same with one or multiple detectors. The summing of the counts from multiple detectors is invisible to the user.

When setting the span, set it for the length that is the total of all the detectors.

Note: In many cases, you cannot fill or empty the process vessel for calibration. Use the following hints in these situations: With the vessel empty, open the source holder shutter to simulate low level (“set low level”) in software. Close the source holder shutter to simulate high level (“set high level”) in software.

GEN2000 Local RS-485 Network

This feature supports gauging systems that require two or more measurement systems that interact to provide a single compensated measurement.

The RS-485 network has the following gauge types:

- Master
- Responder

The gauges use the half-duplex RS-485 communication network. The gauges transfer specific information between each other in the field with only the master gauge actually communicating with the control room.

The master gauge has the following features:

- Initiates all communication on the network
- Keeps a list of expected gauges on the network and cycles through each gauge requesting a response
- Updates the tag, counts information from the responder gauges, and tracks the network health

The responder gauges have the following features:

- Have a unique address for their reply
- Have a table listing other network gauges with information that it requires and the function of that data
- Can listen to all of the responses of the other gauges, which enables each responder gauge to update the count information from other gauges (if setup to do so)

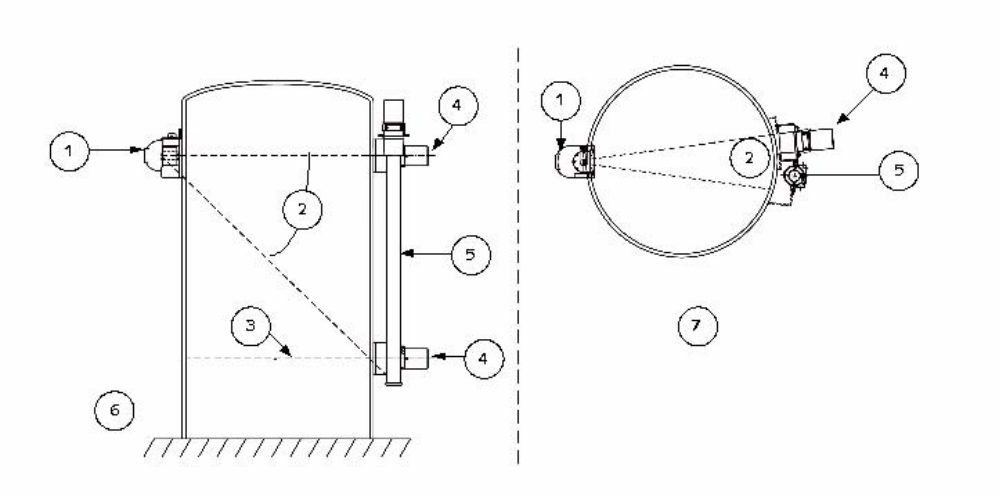


Figure B.5 Typical installation – vapor compensation & auto zero

Figure notes:

1. Radiation source holder

2. Radiation beam

3. Minimum process level measured

4. Radiation detector DSG with HART protocol output using RS-485

5. Radiation detector(s) level with HART protocol output using RS-485

6. Side view

7. Top view

Detector wiring

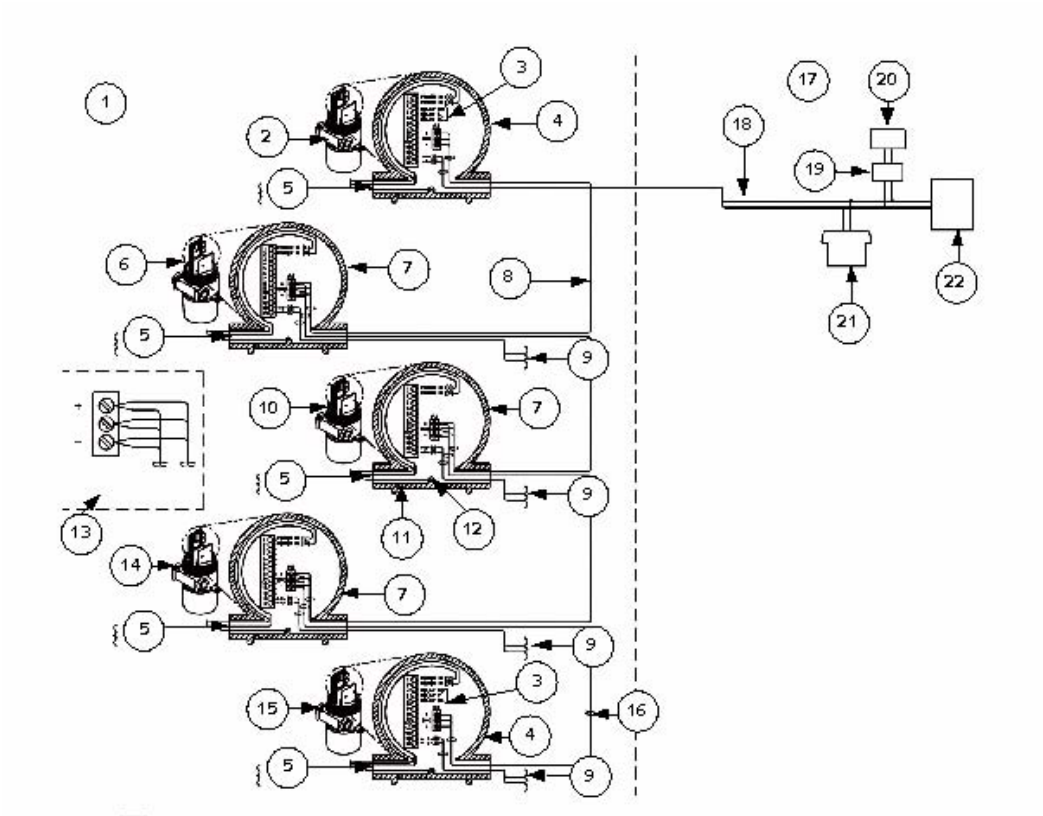


Figure B.6 Interconnect-GEN2000 RS-485 multiple detectors/transmitters

Figure notes:

1. Sensor location
2. High level alarm vapor density
3. Relay
4. DSGH detector
5. Power/Earth ground
6. Top level
7. LFXG-H or LSGH
8. RS-485 signal cable
9. 4 ... 20 mA output

10. Middle level

11. CENELEC ground

12. Housing ground

13. RS-485 connection enlarged

14. Bottom level

15. Low level alarm auto zero

16. Additional detectors (option)

17. Control room

18. 4 ... 20 mA output signal

19. Modem

20. PC

21. Handheld terminal (option)

22. mA input DCS

Software

To setup the RS-485 network you must have a copy of Ohmview 2000 version 1.0.4 or higher.

The Ohmview 2000 Launcher program has the RS-485 feature. Select this feature to choose compensation types and view information about the gauges.

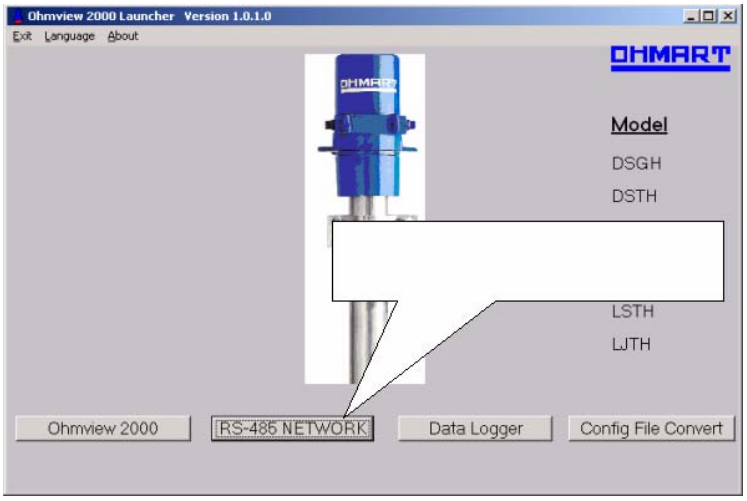


Figure B.7 Ohmview 2000 Launcher program

Note: If it does not connect, click Disconnect, click Exit and entirely close Ohmview 2000. Wait for 30 seconds and open the program again using the Launcher program. Select another port. After selecting the proper port, the program remembers the last port used and selects it again.

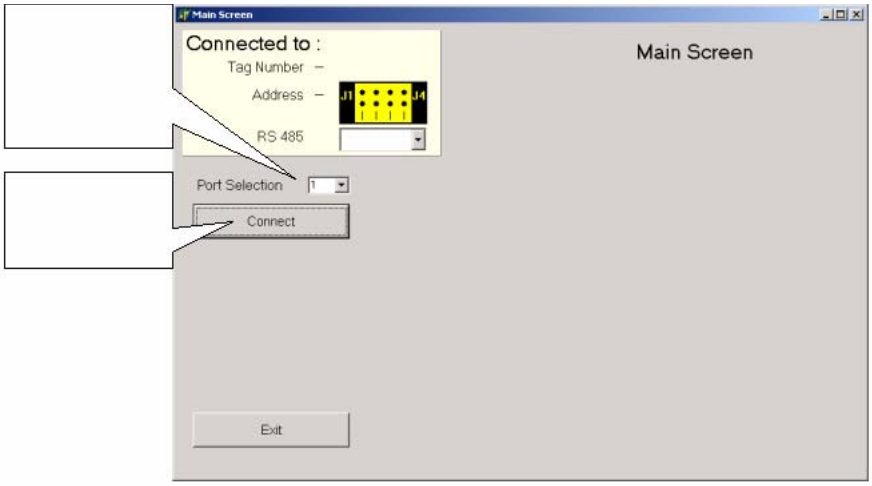


Figure B.8 Ohmview 2000 RS-485 main screen

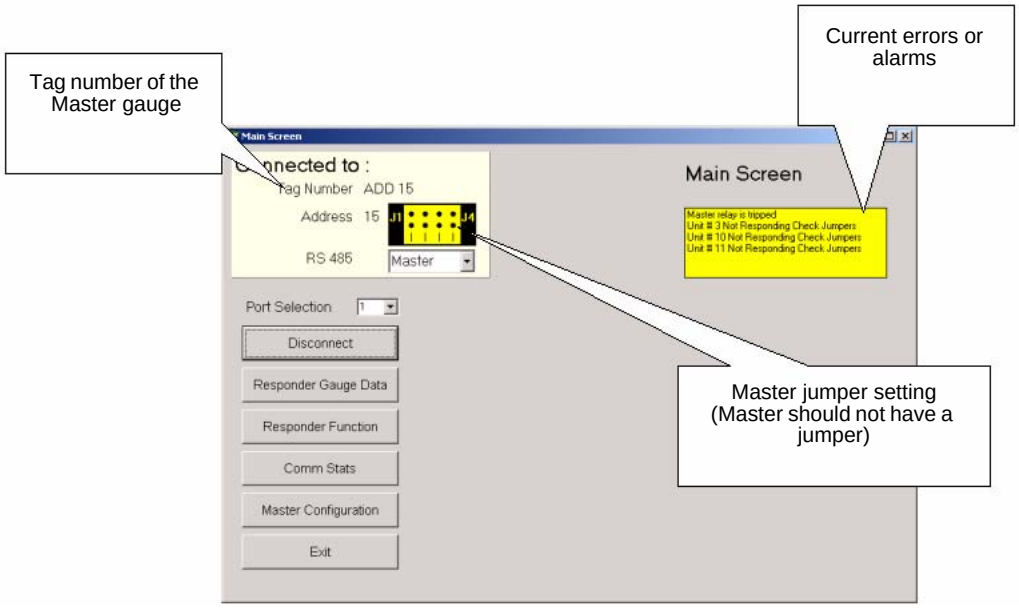


Figure B.9 RS-485 Master Main menu screen

The Main menu for the master contains the following selections:

- Connect or Disconnect – Click to connect or disconnect from the gauge
- Responder Gauge Data – see page B-12
- Responder Function – see page B-13
- Comm Stats – see page B-14
- Master Configuration – see page B-15
- Exit – Click to exit program

Responder Gauge Data

This screen displays the units and the counts for each Responder gauge as selected. If a unit does not display a count, it has not been set up to do so or is not on the network.

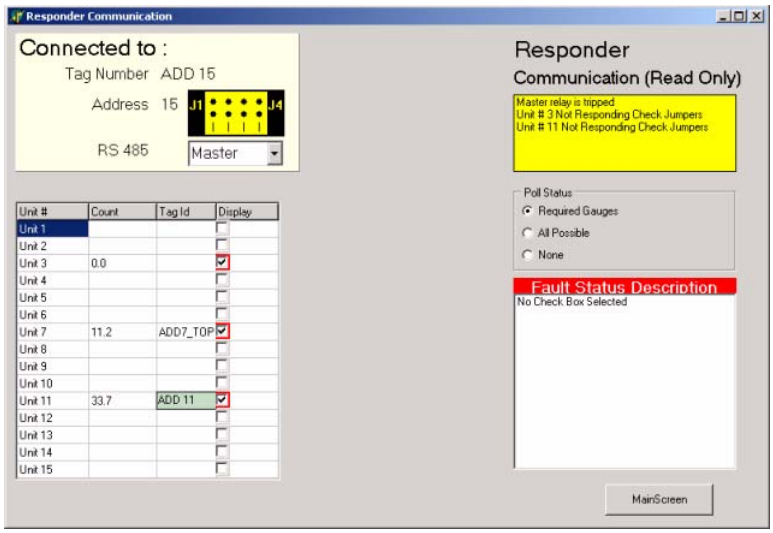


Figure B.10 RS-485 Responder gauge data screen

Responder Function

Use this screen to select the function for different units.

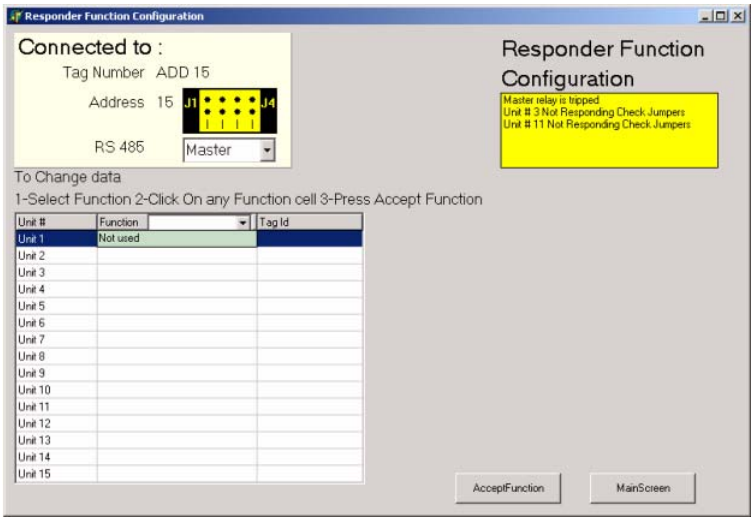


Figure B.11 RS-485 Responder Function screen

The functions available for each responder are:

- Not Used
- Summation
- Vapor Comp
- Auto Zero
- External Summation

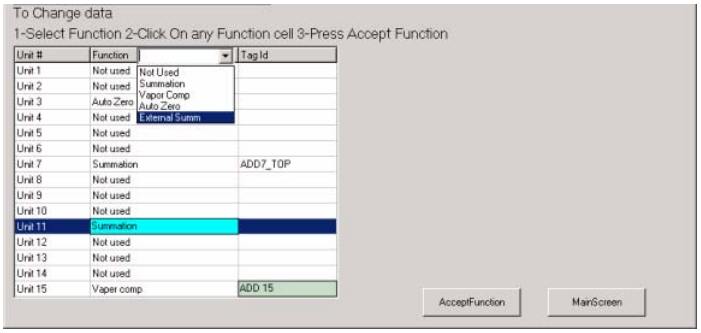


Figure B.12 Responder function pull-down menu

To change the function for a unit, perform the following steps:

Procedure B.2: Changing the Responder unit function

1. Select the Function cell next to the unit number.
2. From the pull-down menu, select the proper function type.
3. Click Accept Function.

Communication Statistics

Use this screen to view the number of times the Master unit has sent messages to the Responder units and the number of times the responder units have replied.

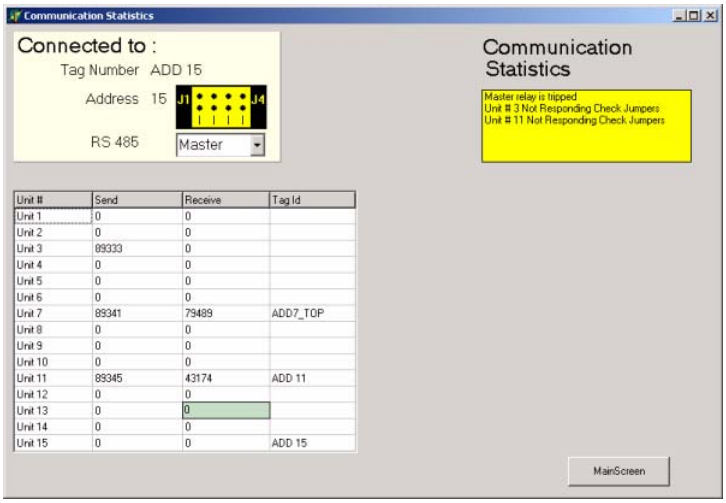

Communication Statistics
Connected to :
Tag Number ADD 15
Address 15
J1
J4
RS 485
Master
Communication Statistics
Master relay is tripped
Unit # 3 Not Responding Check Jumpers
Unit # 11 Not Responding Check Jumpers
Unit # | Send | Receive | Tag Id
Unit 1 | 0 | 0 |
Unit 2 | 0 | 0 |
Unit 3 | 89333 | 0 |
Unit 4 | 0 | 0 |
Unit 5 | 0 | 0 |
Unit 6 | 0 | 0 |
Unit 7 | 89341 | 79489 | ADD7_TOP
Unit 8 | 0 | 0 |
Unit 9 | 0 | 0 |
Unit 10 | 0 | 0 |
Unit 11 | 89345 | 43174 | ADD 11
Unit 12 | 0 | 0 |
Unit 13 | 0 | 0 |
Unit 14 | 0 | 0 |
Unit 15 | 0 | 0 | ADD 15
MainScreen

Figure B.13 RS-485 Communication Statistics screen

Master Configuration

Use this screen to setup the Polling requirements for each unit. Polling activates the function for the unit.

To turn the polling On or Off, double-click on the Poll cell next to the unit number.

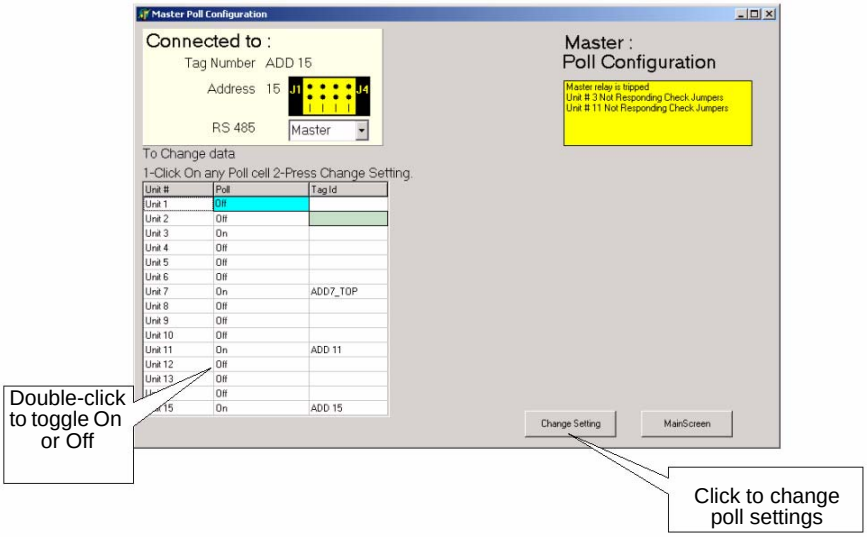


Figure B.14 RS-485 Master Configuration screen

Responder Main menu

To setup and test a specific responder unit, connect the HART modem jumpers anywhere along the 4 ... 20 mA output.

Procedure B.3: Connecting directly to a Responder

1. Open Ohmview 2000 Launcher.
2. Select the proper Port number.
3. Click Connect. The Responder Main Menu screen displays.

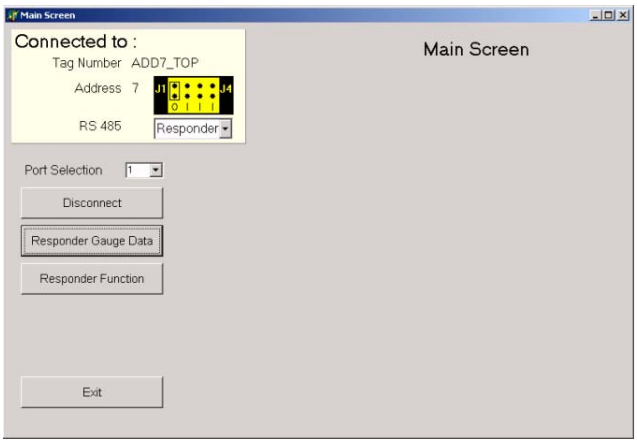


Figure B.15 Responder Main Screen

The following choices are available on this menu:

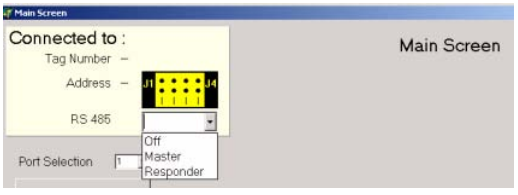
- Responder Gauge Data (see page B-12)
- Responder Function (see page B-13)
- Connect or Disconnect – Click to connect or disconnect from gauge
- Exit – Click to close program

Initial setup

Perform the following steps to set up the GEN2000 RS-485 local network:

Procedure B.4: Setting up GEN2000 RS-485 local network

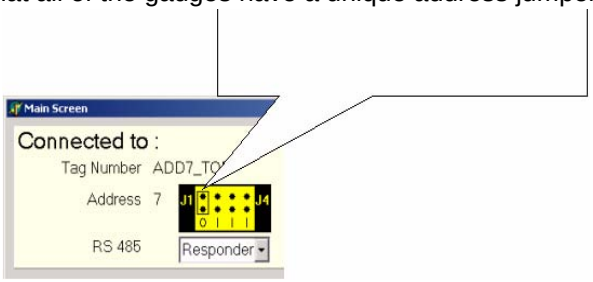
1. Check the wiring connections for power, network and analog output for all gauges.
2. Disconnect the RS-485 network from the master gauge.
3. Verify that the master gauge has no jumpers made (address F).
4. Power up the master gauge.
5. Use the RS-485 configuration program to disable the RS-485 local network. From the Main Screen pull-down menu, select **Off**.



6. Re-connect the RS-485 wiring on the master gauge.

> **Note:** Wire the Master gauge relay as the RS-485 Network Fault relay. Failure to use this relay can result in significant measurement error from incorrect compensation or no compensation.

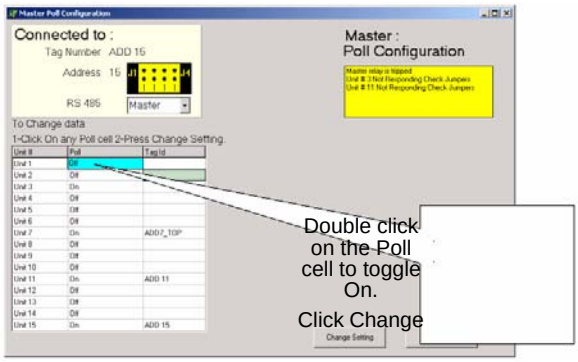
7. Confirm that all of the gauges have a unique address jumper configuration.



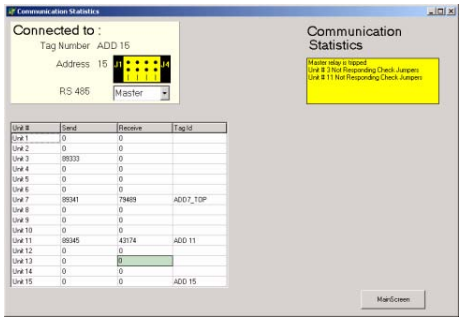
8. Power up all network gauges.

9. Confirm that all hardware is functioning properly.

10. Run the RS-485 configuration program and configure the master gauge to poll all of the gauges on the network.



11. Verify that all gauges are communicating as expected.



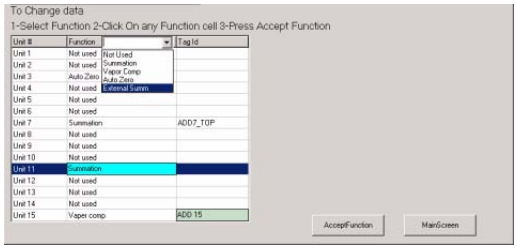
12. Populate the master table to continuously poll all gauges.

13. Enable the RS-485 local network using the configuration program - continuous communication starts.

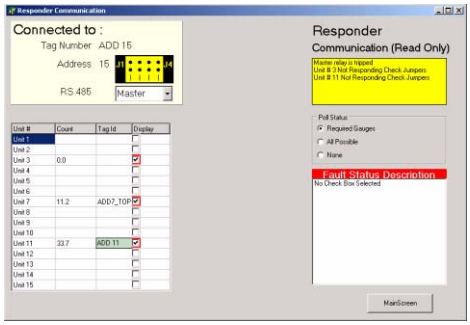
14. Continue to monitor the RS-485 network to verify that all of the gauges are responding as expected.

15. For each gauge on the RS-485 local network:

- Use the RS-485 Configuration software to configure the Responder table.



- Verify that the Responder table contains all of the gauges required for the particular gauge.
- Verify that the Responder table is updating.



16. Connect to each gauge using Ohmview 2000 and setup each gauge for the particular application. Access the Ohmview 2000 electronic manual under Help for further information on setting up the gauge.

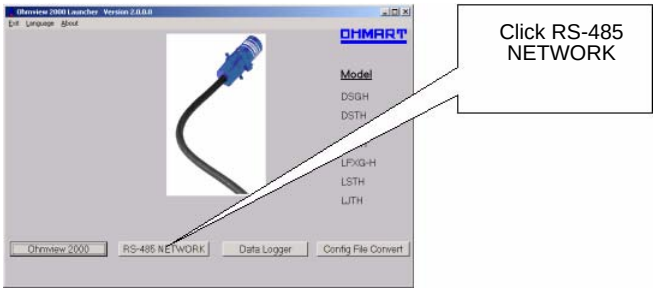
Auto Zero feature

Use this feature with the RS-485 network to provide data to the primary level gauge. The counts feed into the level gauge from the low point indicator on the vessel. When the level gauge senses a preset threshold value, it implements the Auto Zero feature. This feature resets the zero point.

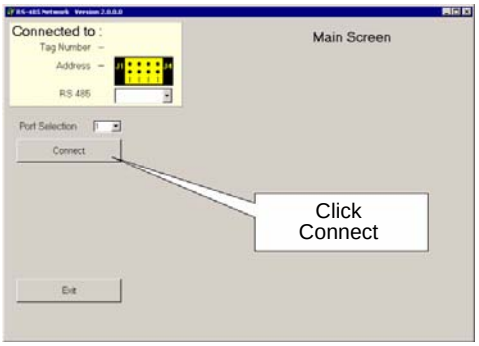
Setting up the Auto Zero feature

To enable this feature using Ohmview 2000's RS-485 Network program, you must have firmware 2000.30 or 30C or higher for GEN2000 instruments.

Procedure B.5: Setting up the Auto Zero feature

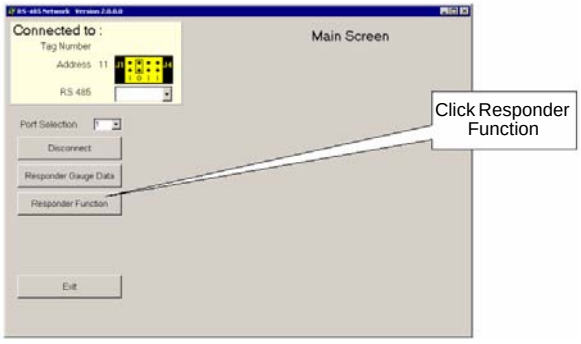
1. Determine the gauge and unit number for your point level indicators.
2. Fill the vessel until the process is just above the low process indicator and record the count.
3. Fill the vessel until the process is just below the low process indicator and record the count.
4. Calculate the 50% level of the two count totals. This number is your auto zero threshold.
5. Open the Ohmview 2000 Launcher program.
6. 

7.

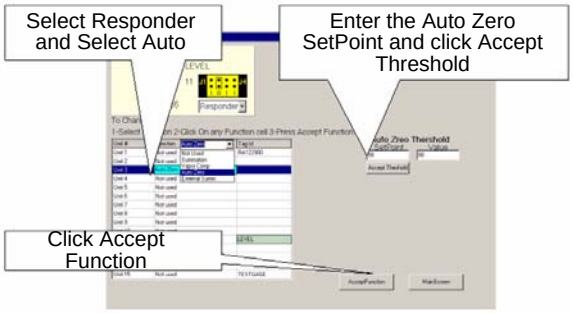


This connects to the gauge that attaches to your HART modem.

8.



9.



10. The Auto Zero feature is enabled.

NORM (naturally occurring radioactive material) compensation

Products that contain natural radioactive materials (for example, radon) may require special compensation of the level measurement. The radiation emitted by the product material can interfere with the measurement, since the detector cannot differentiate between the radiation from the source and the radiation from the product.

Achieve compensation of the measurement by using a second detector that measures only the radiation emitted by the product material. A primary detector measures the process level measurement. The signal from the secondary detector is input to the primary detector. The primary detector runs an algorithm to subtract the effect of the material's radiation from the source holder's radiation.

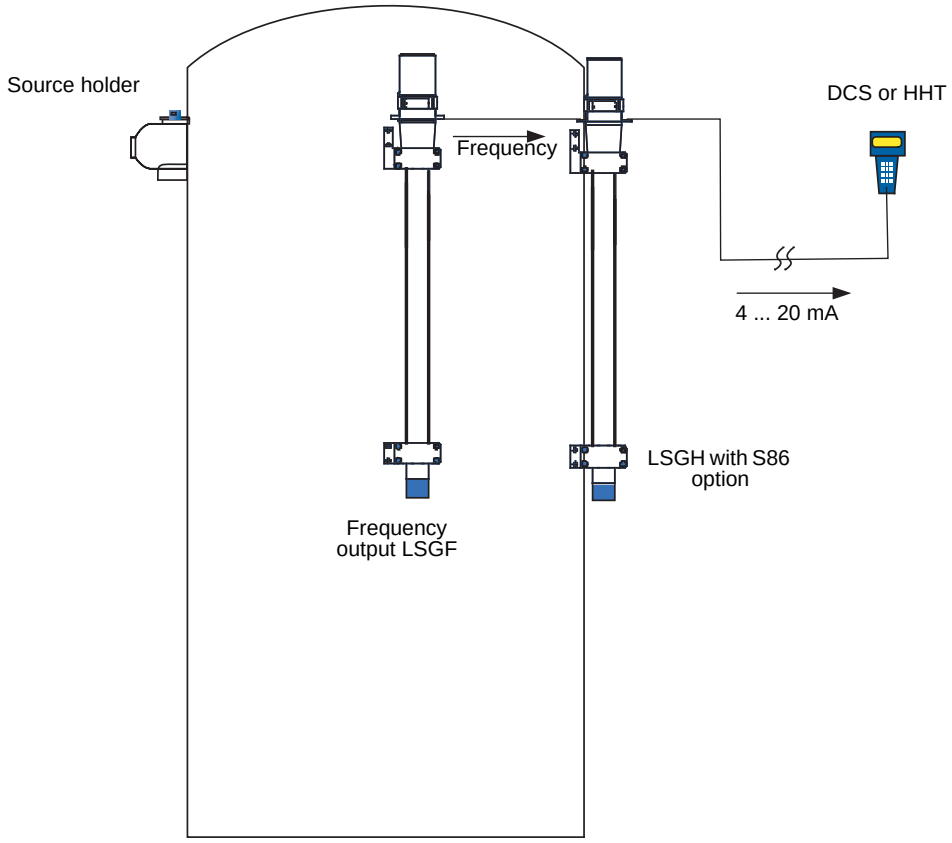


Figure B.16 NORM compensation system

Special drawings for NORM Compensation

Ideally, identification of applications requiring NORM compensation occurs at the time of order. The end user, engineering contractor (or both) may have received certified drawings for the exact equipment ordered. Refer to the drawings along with this section of the manual.

Note: If the instructions on the drawings and this manual differ, follow the drawing instructions. They are specific to your order.

Installation requirements

You must install the detectors correctly for NORM compensation to work.

Mount the primary detector so it is in the source holder radiation beam. Mount the secondary detector so that it is NOT in the source holder radiation beam.

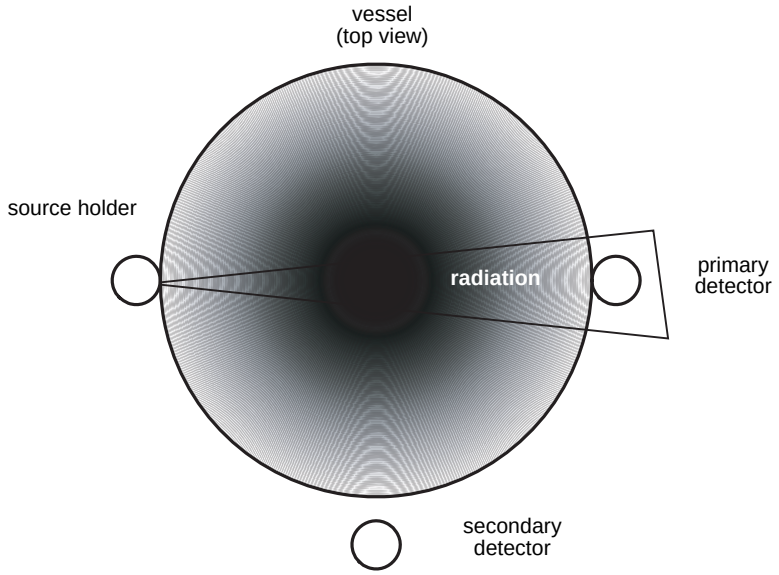


Figure B.17 Placement of detectors for NORM compensation

Detector wiring

Wire the secondary detector into the primary detector as shown in Figure B.18.

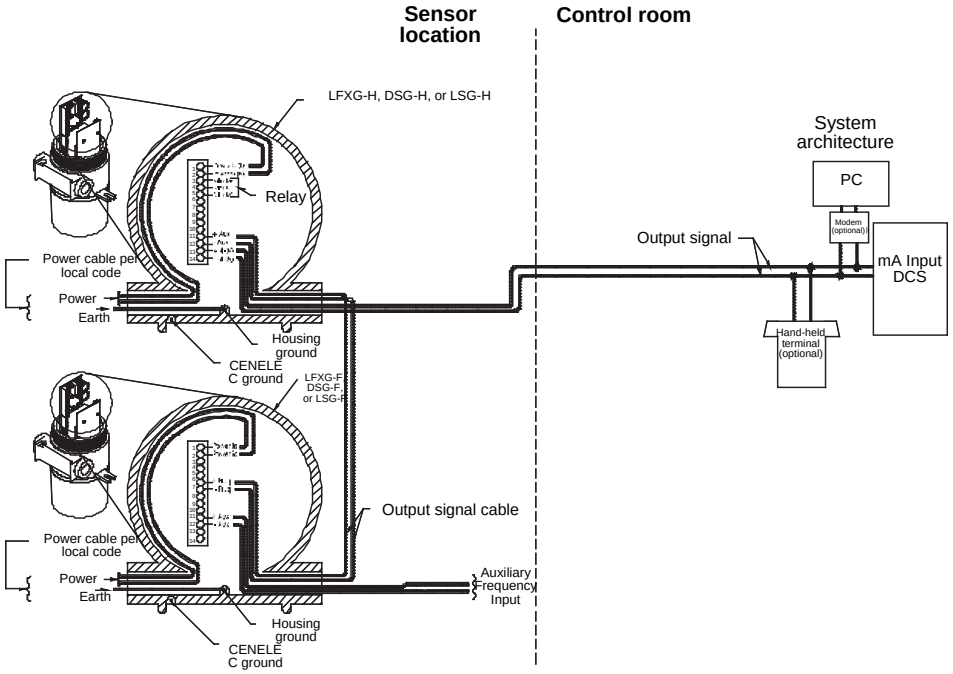


Figure B.18 Interconnect – LSGF with LSGH

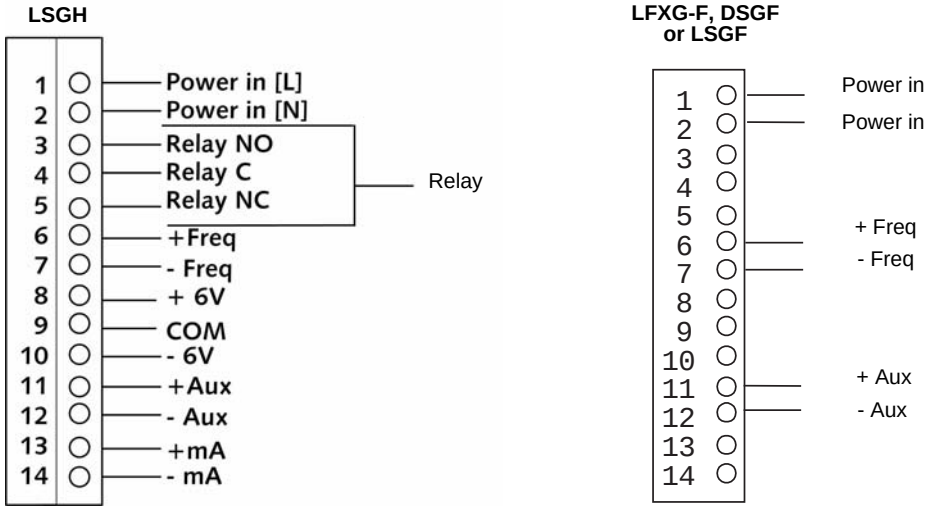


Figure B.19 Dual detector interconnect terminals

Initial settings and calibration requirements for NORM compensation

Specific software settings and calibration procedures are required for NORM compensation.

Setting up NORM compensation

Procedure B.6: Setting up NORM compensation

1. From the **Main menu**, select **Initial setup | Auxiliary input | Compensation**.
   The compensation screen displays the current type of auxiliary input.
2. From the **Compensation** menu, select **Type | Compensation**.
3. Press F4 to enter.
4. If using a hand-held HART communicator, press F2 to send the settings to the transmitter.

Calibrating with NORM compensation

Before calibrating, make sure the NORM compensation option is set up. Refer to Procedure B.6: "Setting up NORM compensation".

Note: To calibrate the NORM compensation system, you must be able to fill the vessel to the maximum level with radioactive product.

Procedure B.7: Calibrating with NORM compensation

1. Set the product level to maximum.
2. Turn the source holder shutter to “OFF” (this ensures that the only radiation picked up by the detector comes from the product and not the source).
3. Perform a data collect of the primary sensor:
   - From the **Main menu**, select **Calibrations | Data collect**.
   - Record the value of the counts from the primary data collect.
4. From the **Main menu**, select **Initial setup | Auxiliary input | NORM | Aux data collect**.
5. At the prompt, select **Yes** to take data. Record the value of the counts from the Auxiliary data collect.

6. From the **NORM** compensation screen, select **Gain**. Adjust the gain value as follows:
   - Compare the counts from the primary and auxiliary data collects.
   - If the auxiliary channel data collect counts are higher than the primary sensor data collect counts, adjust the NORM compensation gain down. Select **Yes** to accept the counts and press F4 to enter.
   - If the auxiliary counts are lower than the primary counts, adjust the NORM compensation gain up.
7. Repeat the auxiliary data collect and gain adjustment steps until the auxiliary channel counts are within +/-10% of the primary sensor counts.
8. If using a hand-held HART communicator, press F2 to send the settings to the transmitter.
9. Follow the procedures for performing a Two-point calibration and linearizer curve from the “Calibration” chapter of this manual. These procedures require changing the product level from minimum to maximum and collecting data.
10. Complete the linearization and calibration with the Procedure 3.7: "Calculating the linearizer" and Procedure 3.8: "Calculating the calibration result". See page 3-19.

Vapor pressure compensation

A nuclear level gauge works on the principle that the product shields the detector from the radiation beam, allowing more or less radiation to strike the detector as the product level falls and rises. For an accurate level indication, the variation in the detector output should depend only on the product level.

However, vapor pressure variations in the headspace of the vessel can cause erroneous product level indications. This is because the vapor also blocks some of the radiation. When the pressure is higher, more radiation is blocked; when the vapor pressure is lower, less is blocked. Therefore, even at the same product level, the detector can receive varying amounts of radiation, depending on the head vapor pressure.

You can compensate for this by using a point detector (model DSGH) to separately measure the radiation passing through the vapor space. This detector signal and the signal from the continuous level detector combine to eliminate the effect of the vapor pressure on the level indication.

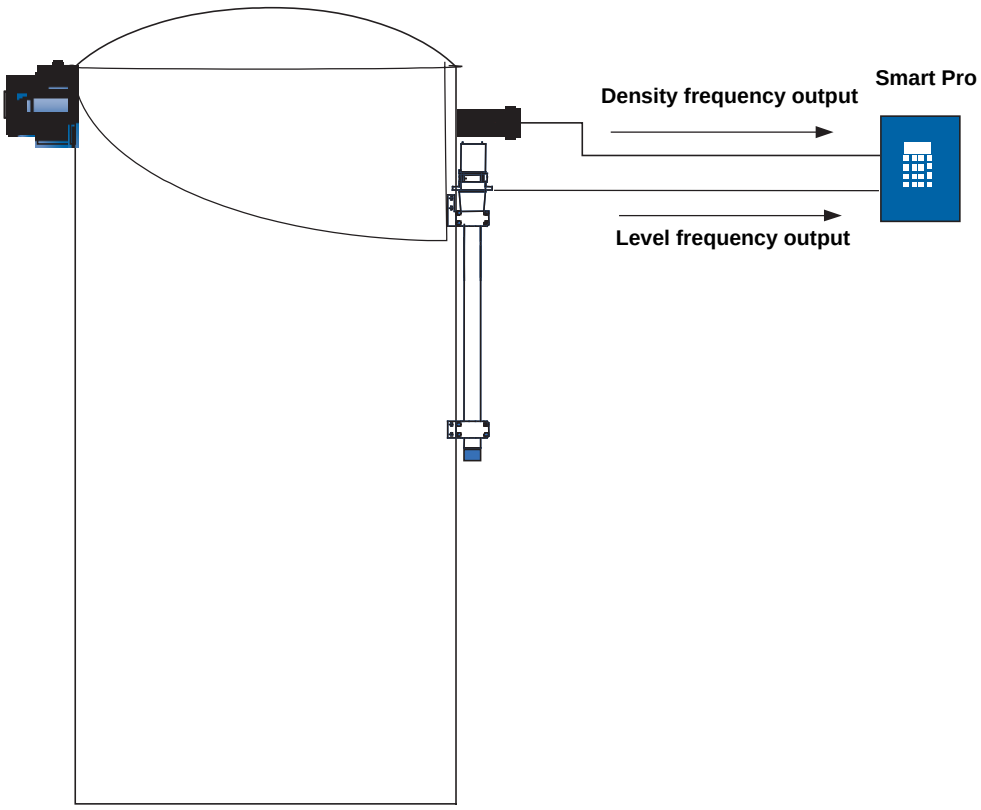


Figure B.20 Vapor compensation system

Installation requirements

A vapor compensation system requires two detectors: the point detector (model DSGH) to measure the vapor space, and the continuous level detector to measure the product level.

Both must be in the radiation beam from the source holder. Mount the DSGH so that it is above the highest expected product level.

Detector wiring

The level detector provides a frequency signal to the DSGH. The output of the DSGH is the calibrated, vapor compensated, 4 ... 20 mA signal for control and HART communication. Figure B.21 illustrates the interconnection between the density gauge and the level gauges.

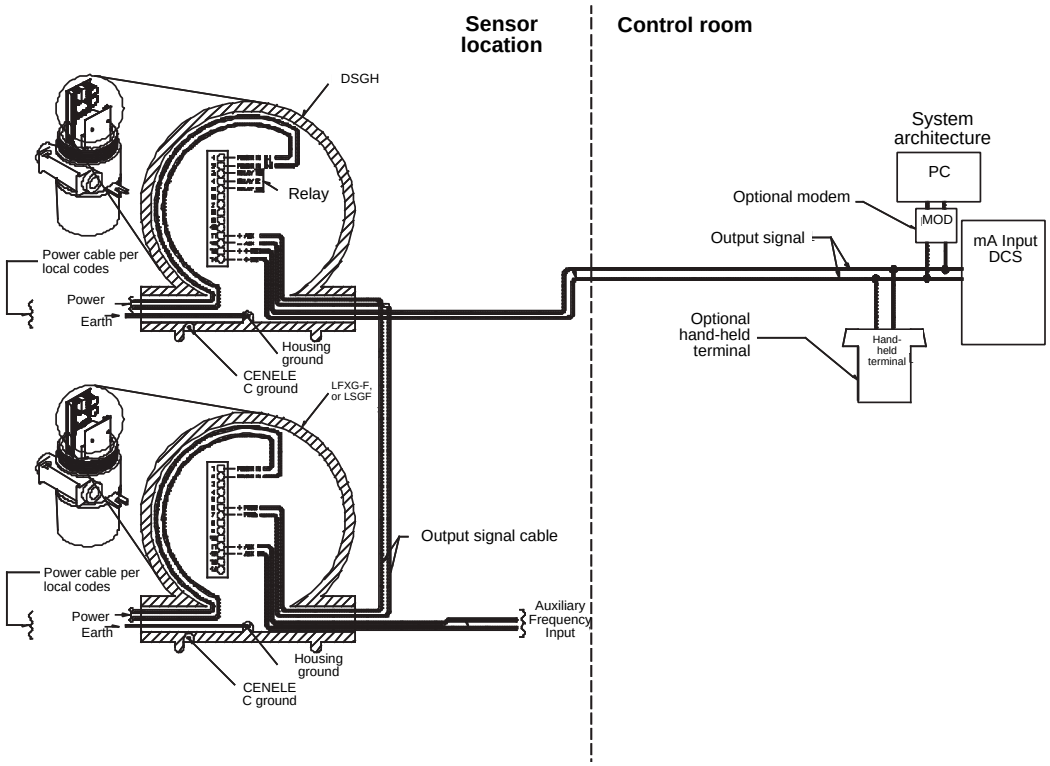


Figure B.21 Interconnect DSGH with LSGH

Algorithm for vapor comp

The vapor compensation algorithm adjusts the percent span based on a percent change in vapor density from a reference density. (Refer to the “Calibration” chapter for a complete discussion of continuous level gauge calibrations.)

Each time the gauge computes a level measurement, a new Cal low counts value calculates, which changes the percent span. The algorithm for calculating the cal low counts is:

> New cal low counts=cal low counts * (1-(vc gain * % change in vapor density counts))

Where:

> % change in vapor density counts=(reference counts-vapor density counts)/ reference counts

Variable definitions

Reference counts
Reference counts are counts from DSGH at reference pressure condition (determined during first step of calibration).

Vapor density counts
Vapor density counts are counts from DSGH at current pressure condition.

VC gain
VC gain is the vapor compensation gain (user enters value during calibration).

Initial settings and calibration for vapor comp

Setting up vapor compensation

Procedure B.8: Setting up vapor compensation

1. Perform the following steps to set the DSGH up as a level gauge:
   - From the **Main menu**, select **Advanced Fxns | Select Gage type | Level**.
   - Press F2 to send to the transmitter.
2. Return to the **Main menu**.
3. Perform the following steps to select Vapor compensation:
   - From the **Main menu**, select **Auxiliary input | Compensation | Type | Vapor**.
   - Press F4 to enter. You return to the **Compensation** menu.
4. Return to the **Auxiliary input** menu.

5. From the **Auxiliary input** menu, select **Filter TC**.
6. Set the filter time constant. For best response, this value should be five seconds. If this value is too large (>10sec), the system response slows, with long settling times on the final output.
7. From the **Compensation** menu, select **Vapor**.
8. From the **Vapor** menu, select **Gain**.
   - Set the Gain to 1.0.
   - You adjust it again during the calibration procedure.
9. If using a hand-held HART communicator, press F2 to send the settings to the transmitter.

Calibrating with vapor compensation

Before calibrating, make sure the vapor compensation option is set up (see “Setting up vapor compensation” on page B-28).

Note: To calibrate the vapor pressure compensation system, you must be able to adjust both the product level and the vapor pressure.

Calibrating with vapor compensation

Procedure B.9: Calibrating with vapor compensation

1. Set the vapor pressure to a typical pressure (this is the reference pressure). At this point, the product level is not important, as long as the density gauge is not blocked by the product.
2. From the **Main menu**, select **Initial setup | Auxiliary input | Vapor**.
3. From the **Vapor** menu, select **Aux data collect** (This determines the reference counts for the vapor compensation algorithm.)
4. At the prompt, select **Yes** to take data. When data collection is complete, select **Yes** to save the vapor pressure reference counts.
5. If using a hand-held HART Communicator, press F2 to send the settings to the transmitter.
6. Return to the **Main menu**.
7. Follow the procedures for performing a Two-point calibration and linearizer curve from the “Calibration” chapter of this manual.
   - These procedures require changing the product level from minimum to maximum and collecting data.
   - During the calibration and linearization procedure, maintain the reference pressure in the headspace.

8. Complete the linearization and calibration with the Procedure 3.7: "Calculating the linearizer" and Procedure 3.8: "Calculating the calibration result". See page 3-19.
9. Set the product to the lowest possible level while at the maximum pressure.
10. Set the vapor density to its highest possible value.
11. Note the level indication (it will probably be upscale).
12. From the **Initial setup** menu, select **Auxiliary input | Vapor | Gain**.
13. Adjust the vapor compensation gain value until the level indication reads the correct, minimum level value.
14. Press **F2** to send to the transmitter.

Internal heater kit for applications rated at -50 °C

A heater kit option is available for the LSGH for applications that require a -50 °C (-58 °F) temperature rating. With the heater option, the internal temperature of the unit rises approximately 30 °C (54 °F).

The features of the heater are as follows:

- The heater kit does not affect the functionality of the LSGH in any way. There is no requirement for special firmware.
- The factory installs the internal heater kit if you order it with the LSGH.
- Retrofits are available for previously installed equipment.
- Three different kits are available, one for 115VAC, one for 220VAC, and one for 24VDC. The part numbers are shown below:

Table B.3 Heater kit part numbers

Heater kit power	VEGA Part Number
115 VAC	240723
220 VAC	240724
24VDC	241912

Changes to specifications

The power rating changes from the specifications on page 1-5 of this manual when you install the heater kit on the LSGH.

With the installation of the heater, the maximum power consumption increases to 25W.

The unit is either 115VAC±10% or 220VAC±10% instead of the standard 90-270VAC range or 24VDC.

APPENDIX

C

PRESERVING INFORMATION FROM SMART PRO TO THE LSGH

This appendix describes how to preserve information from an existing level gauge to the LSGH.

Preserving information from Smart Pro

If you have existing Smart Pro electronics (Smart Pro or Smart Pro Pac), you can preserve information on setup and calibration from the Smart Pro electronics. This information can transfer to the new transmitter electronics, saving a great deal of time commissioning the gauge.

Note: Smart 1 and Smart 2 electronics users can preserve the information from their systems and transfer it to the HART electronics. We recommend consulting VEGA Field Service for help on your individual installation.

Note: EDS users cannot transfer information to the HART electronics. You must perform new setup and calibration procedures.

After the new electronics are installed, refer to Appendix A: “Initial factory setup” to enter the correct parameters. Proceed to Chapter 3: “Calibration” for instructions to calibrate the gauge.

Use the following table to record data from the Smart Pro:

Table C.1 Smart Pro data record

Smart Pro parameter	Smart Pro screen/ item	Value	Corresponding HART parameter
Standardize parameter	520/25		–
Standardize parameter	520/26		–
Process low value (Low sample input)	520/32		Cal low level
Process high value (High sample input)	520/33		Cal high level
Cal low counts	520/39		Counts low
Cal high counts	520/40		Counts high
Time constant	527/0		Filter
Fast response filter (chrontrol)	527/1		Threshold
Span	527/2		N/A
Output min	527/10		4 mA level
Output max	527/11		20 mA level
Linearizer curve On/Off	528/41		N/A
Low product value	528/42		Min level
High product value	528/43		Max level

Use Table C.2 to record the linearizer table information. Transferring this information makes a new initial calibration procedure unnecessary. (If you prefer to do a new initial calibration, refer to the “Calibration” chapter of this manual for instructions.)

To calculate the new value to enter into the HART version linearizer table, divide the Smart Pro value of each point by 100. For example, if the Smart Pro value of point 2 is 630, enter 6.30 as the corresponding HART 5.0% point.

Table C.2 Linearizer record

Linearizer table points	Smart Pro Screen/item	Smart Pro Value	HART Linearizer table point (%span)	HART Linearizer table (Smart Pro Value ÷ 100)
0	528/0		0.0%	
1	528/1		2.5%	
2	528/2		5.0%	
3	528/3		7.5%	
4	528/4		10.0%	
5	528/5		12.5%	
6	528/6		15.0%	
7	528/7		17.5%	

Table C.2 Linearizer record (continued)

Linearizer table points	Smart Pro Screen/item	Smart Pro Value	HART Linearizer table point (%span)	HART Linearizer table (Smart Pro Value ÷ 100)
8	528/8		20.0%	
9	528/9		22.5%	
10	528/10		25.0%	
11	528/11		27.5%	
12	528/12		30.0%	
13	528/13		32.5%	
14	528/14		35.0%	
15	528/15		37.5%	
16	528/16		40.0%	
17	528/17		42.5%	
18	528/18		45.0%	
19	528/19		47.5%	
20	528/20		50.0%	
21	528/21		52.5%	
22	528/22		55.0%	
23	528/23		57.5%	
24	528/24		60.0%	
25	528/25		62.5%	
26	528/26		65.0%	
27	528/27		67.5%	
28	528/28		70.0%	
29	528/29		72.5%	
30	528/30		75.0%	
31	528/31		77.5%	
32	528/32		80.0%	
33	528/33		82.5%	
34	528/34		85.0%	
35	528/35		87.5%	
36	528/36		90.0%	
37	528/37		92.5%	
38	528/38		95.0%	
39	528/39		97.5%	
40	528/40		100.0%	

Notes

APPENDIX

D

HART MENUS AND SCREENS

The following charts illustrate the HART hand-held communicator menus and screens.

If using VEGA View, refer to the “VEGA View User Manual”, part number 237855, for description of the VEGA View HART menus and screens.

If using Ohmview 2000, refer to the electronic user manual on the software CD, part number 243008 for a description of the software menus and tabs.

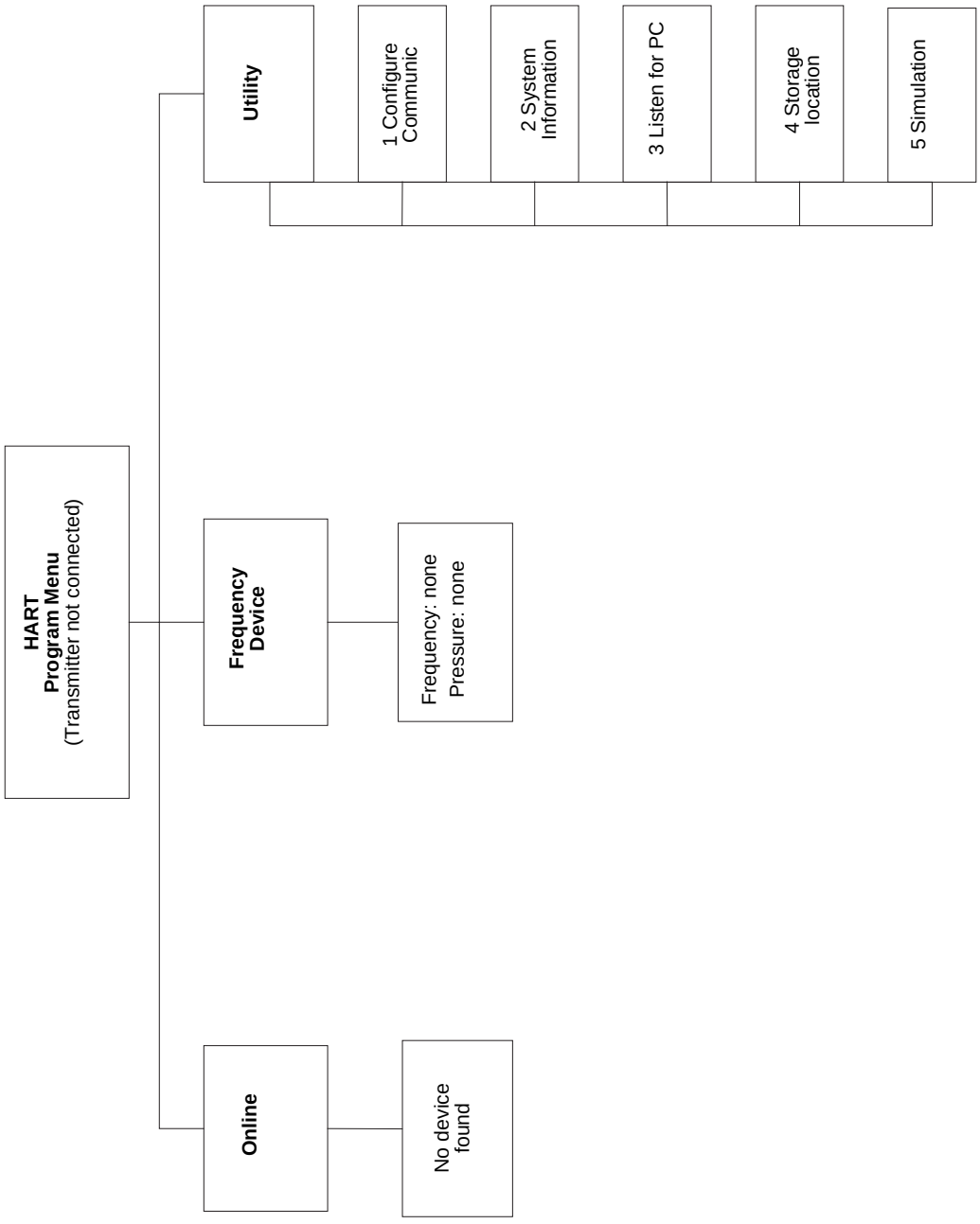


Figure D.1 HART screen – Transmitter not connected

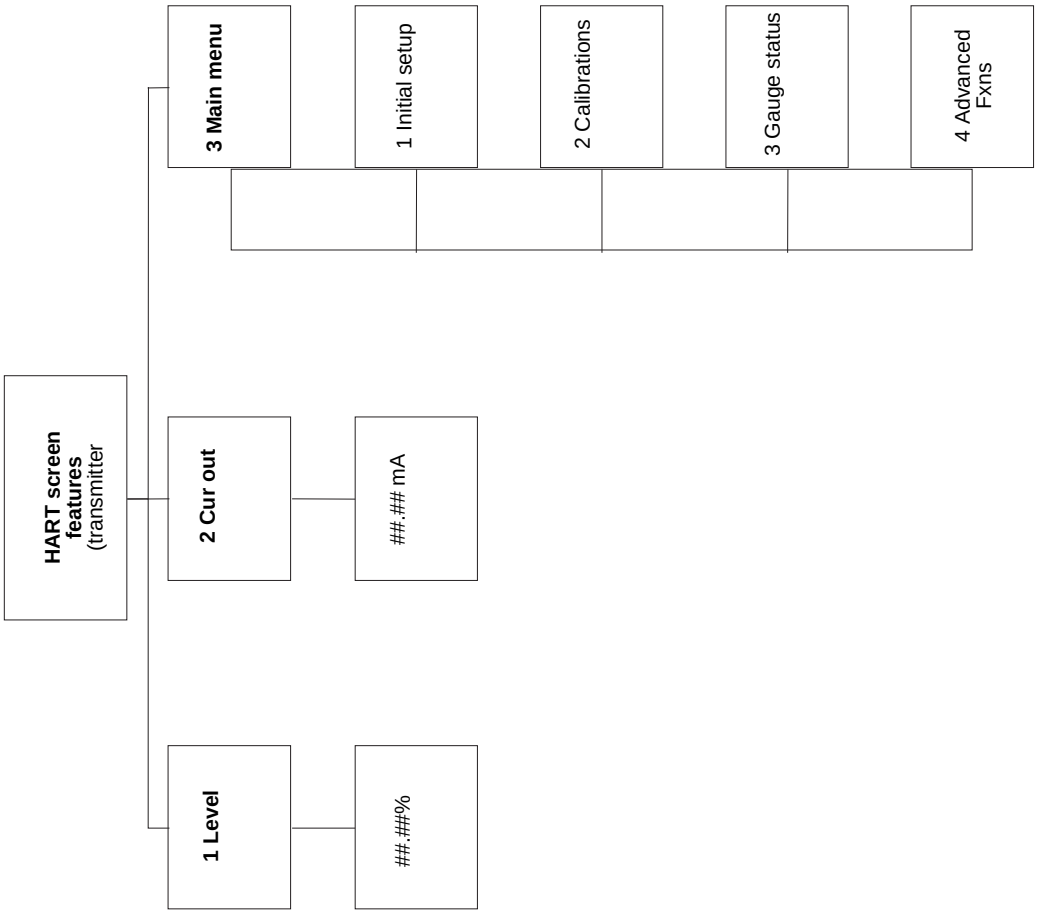


Figure D.2 HART screen – Online

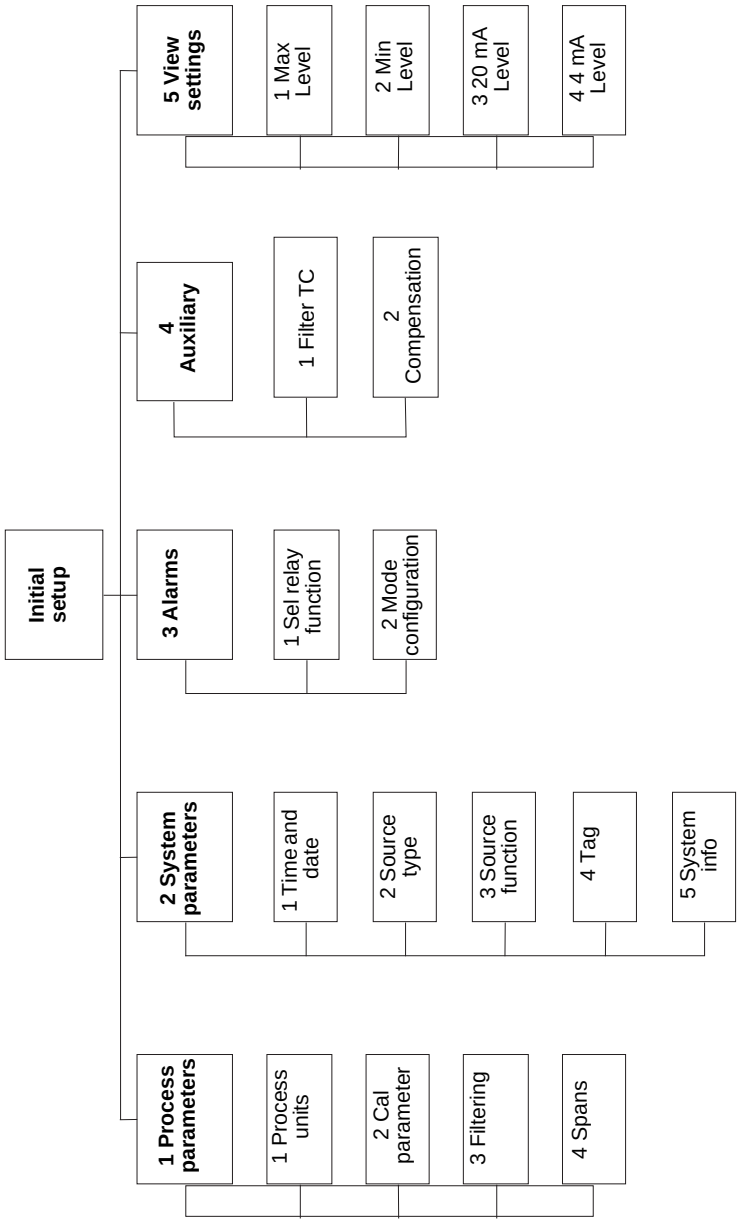


Figure D.3 Initial setup

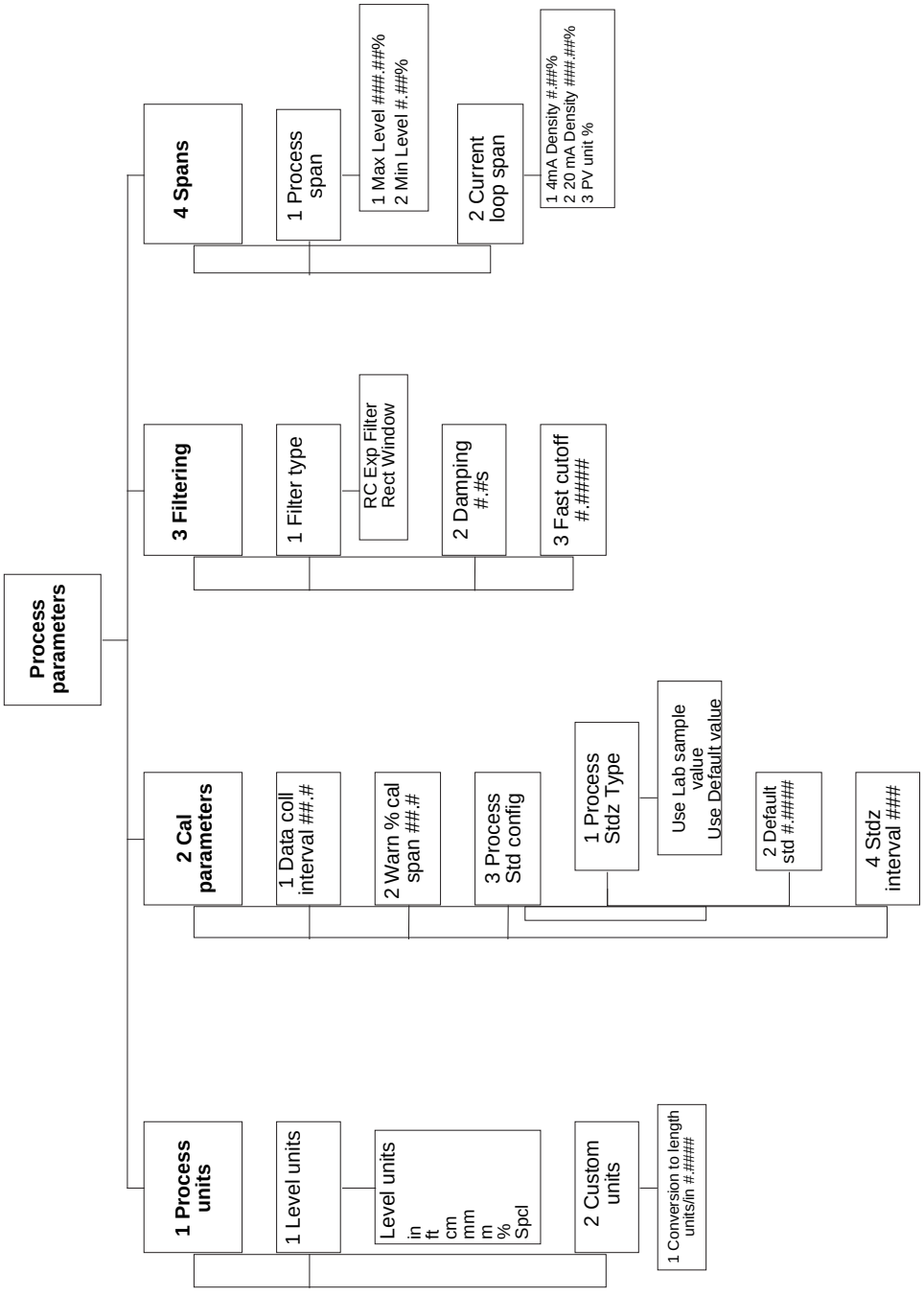


Figure D.4 Process parameters

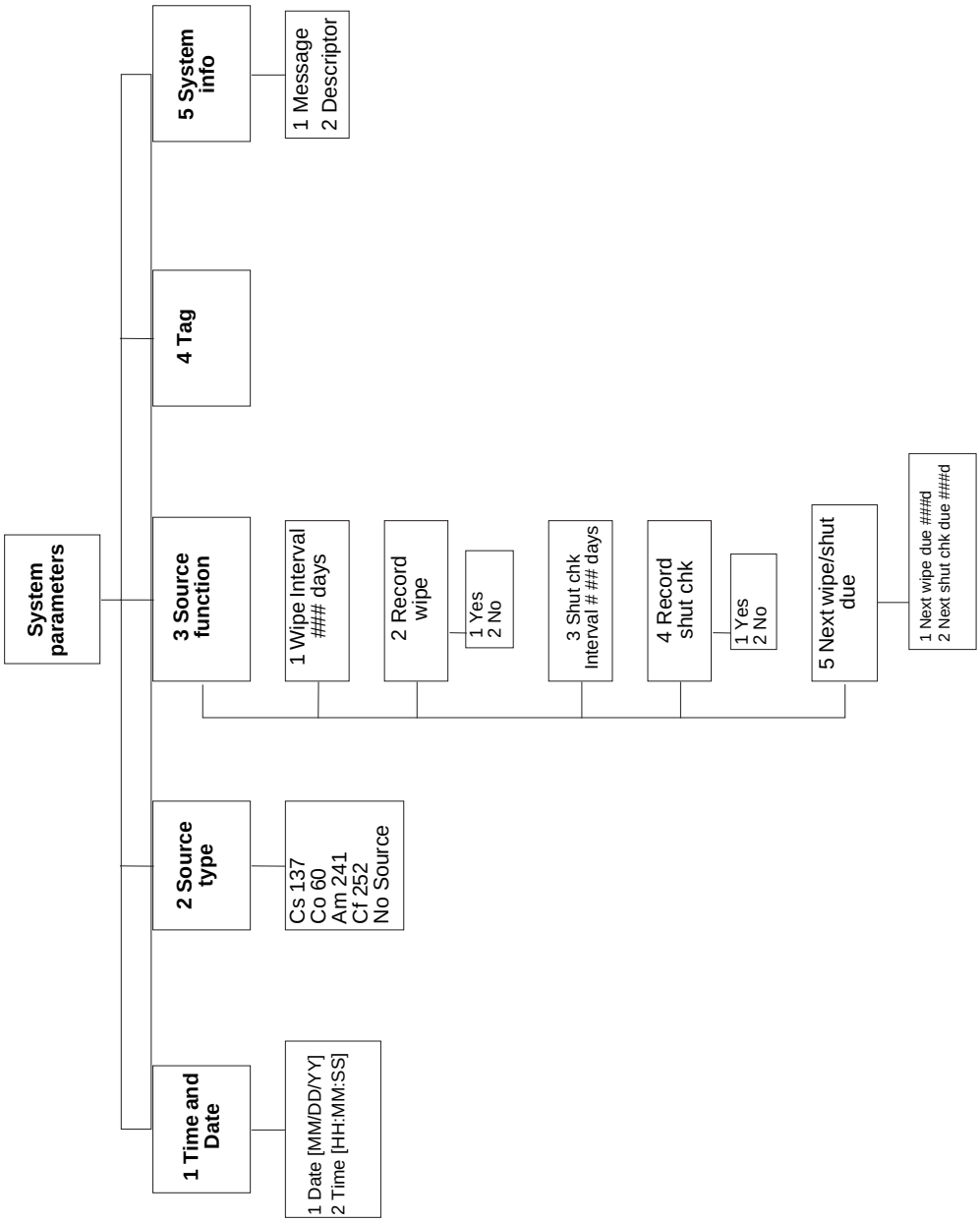


Figure D.5 System parameters

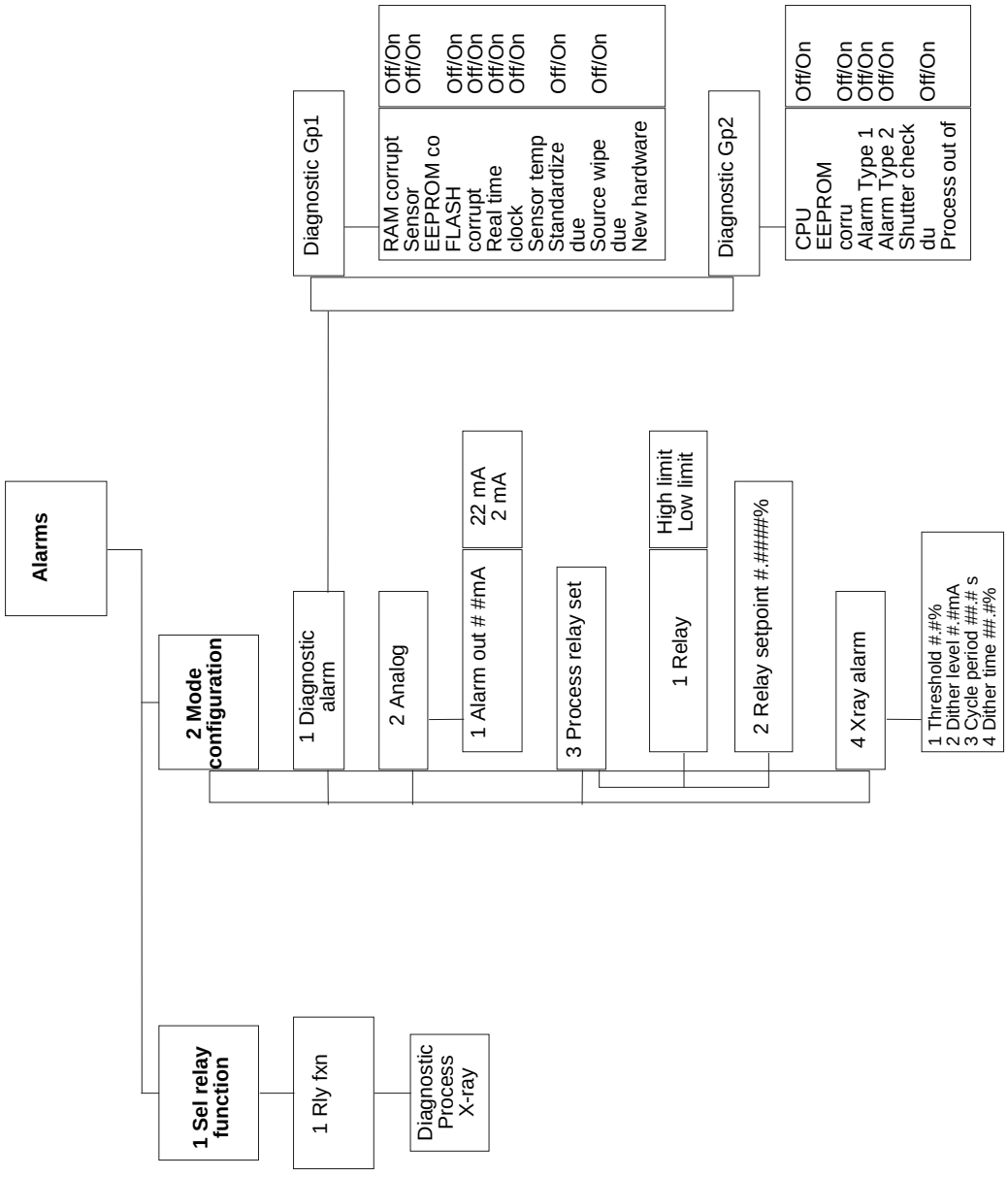


Figure D.6 Alarms

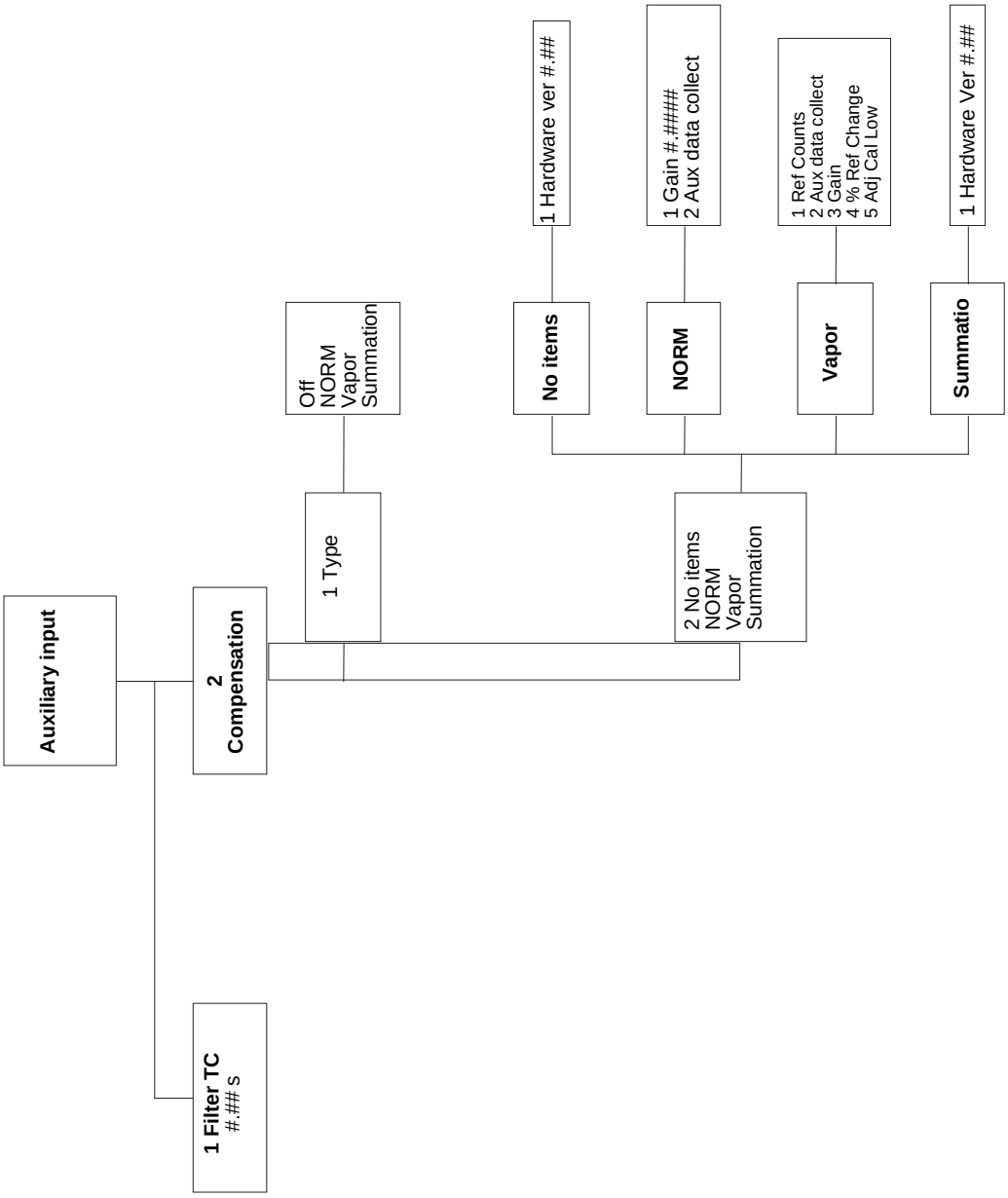


Figure D.7 Auxiliary input

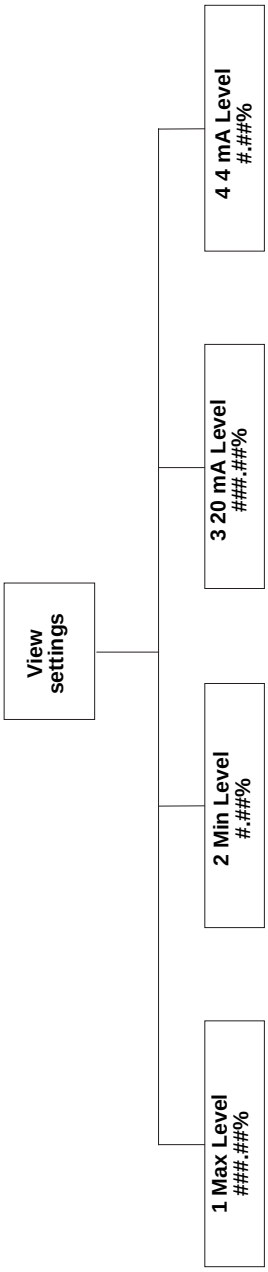


Figure D.8 View settings

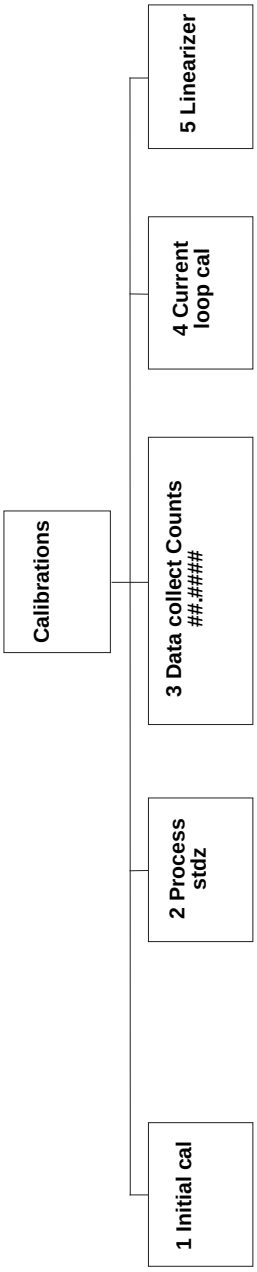


Figure D.9 Calibrations

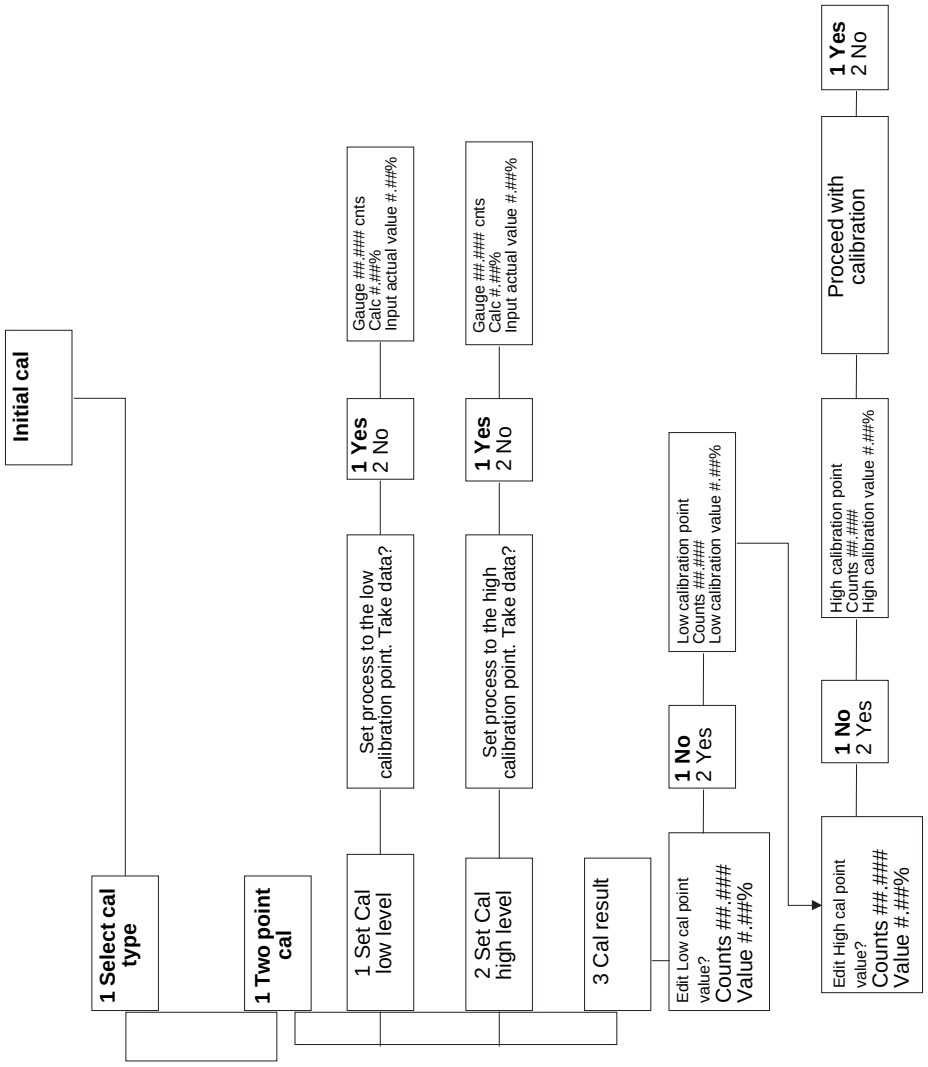


Figure D.10 Initial cal

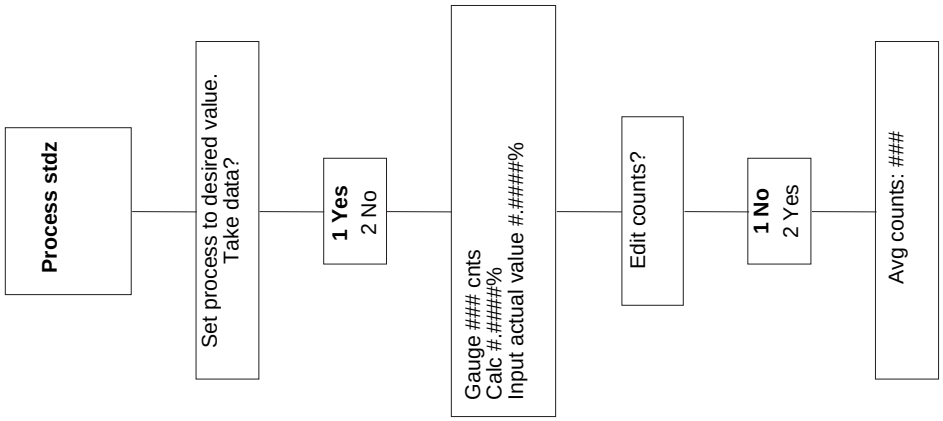


Figure D.11 Process stdz

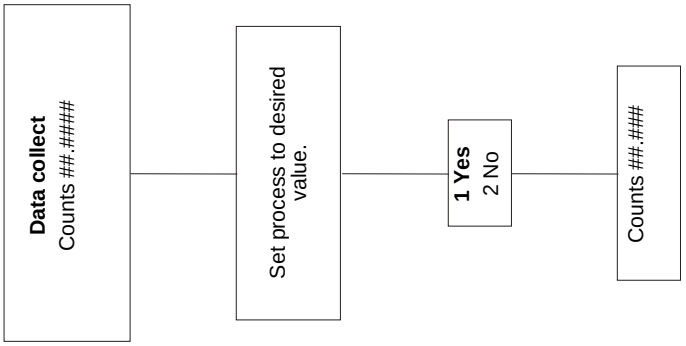


Figure D.12 Data collect

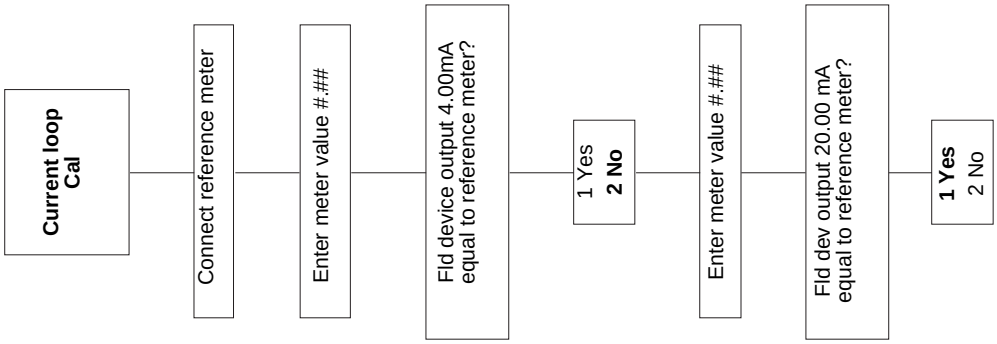


Figure D.13 Current loop Cal

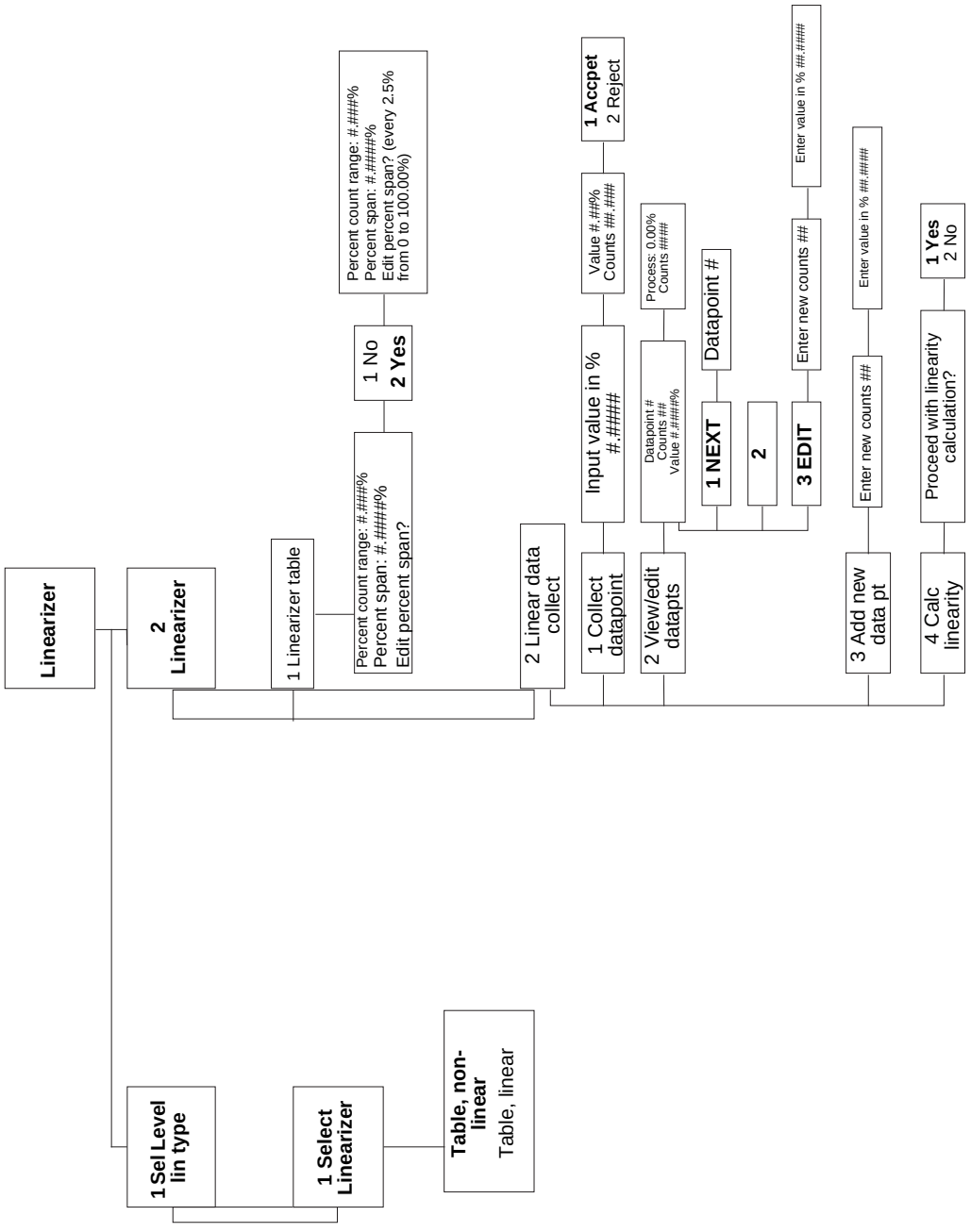


Figure D.14 Linearizer

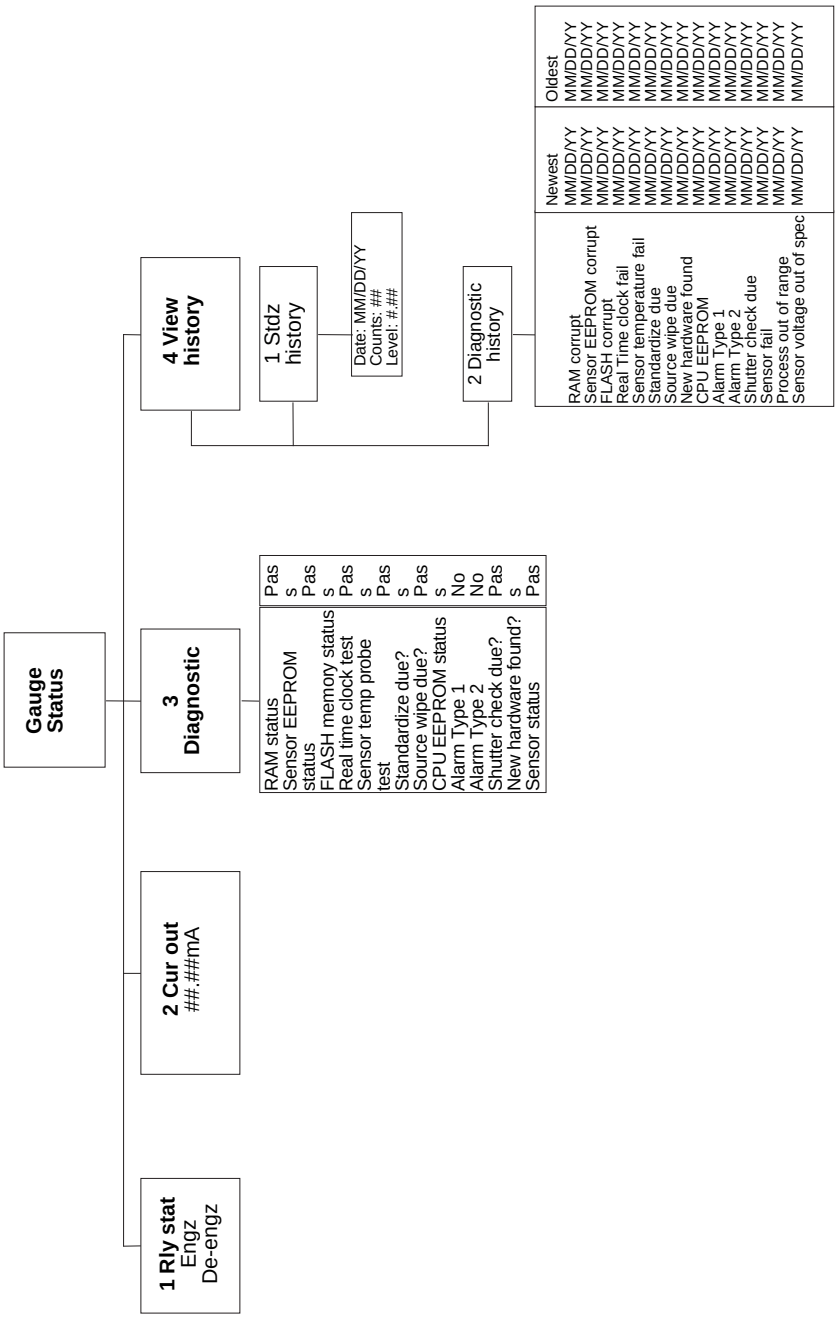


Figure D.15 Gauge status

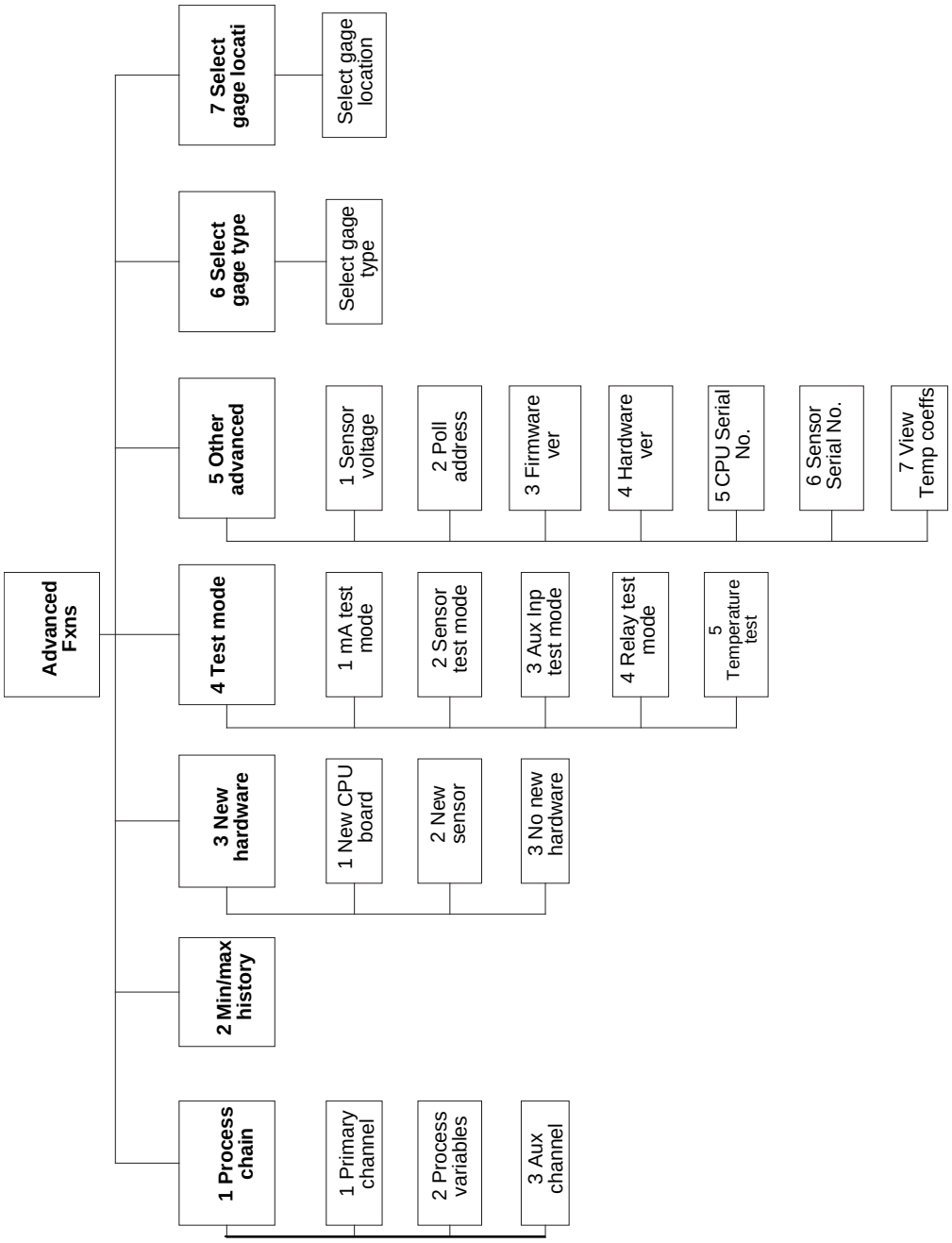


Figure D.16 Advanced Fxns

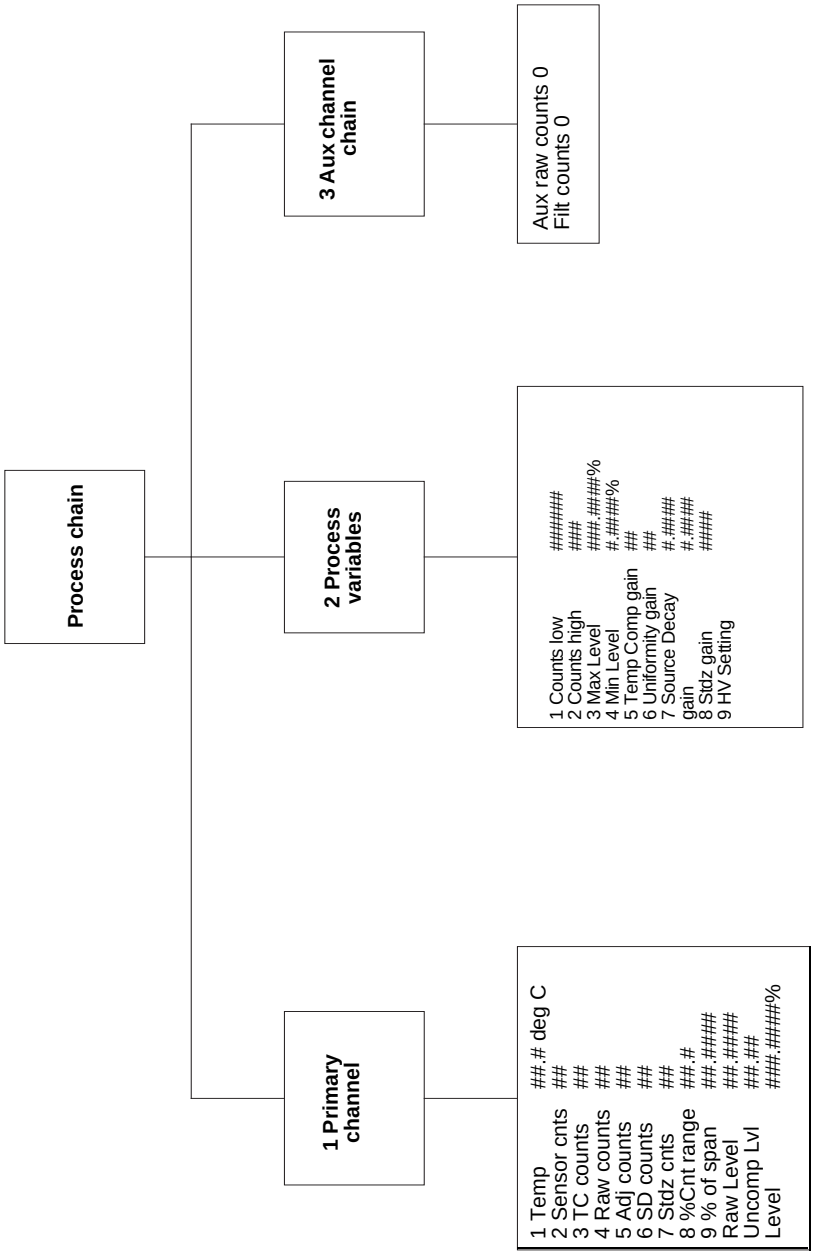


Figure D.17 Process chain

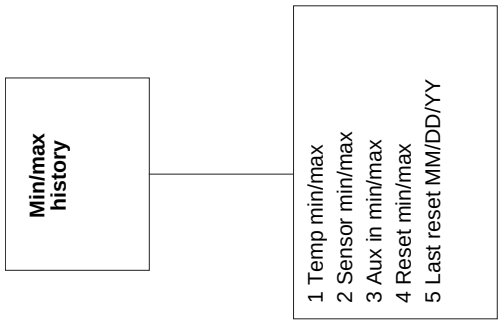


Figure D.18 Min/max history

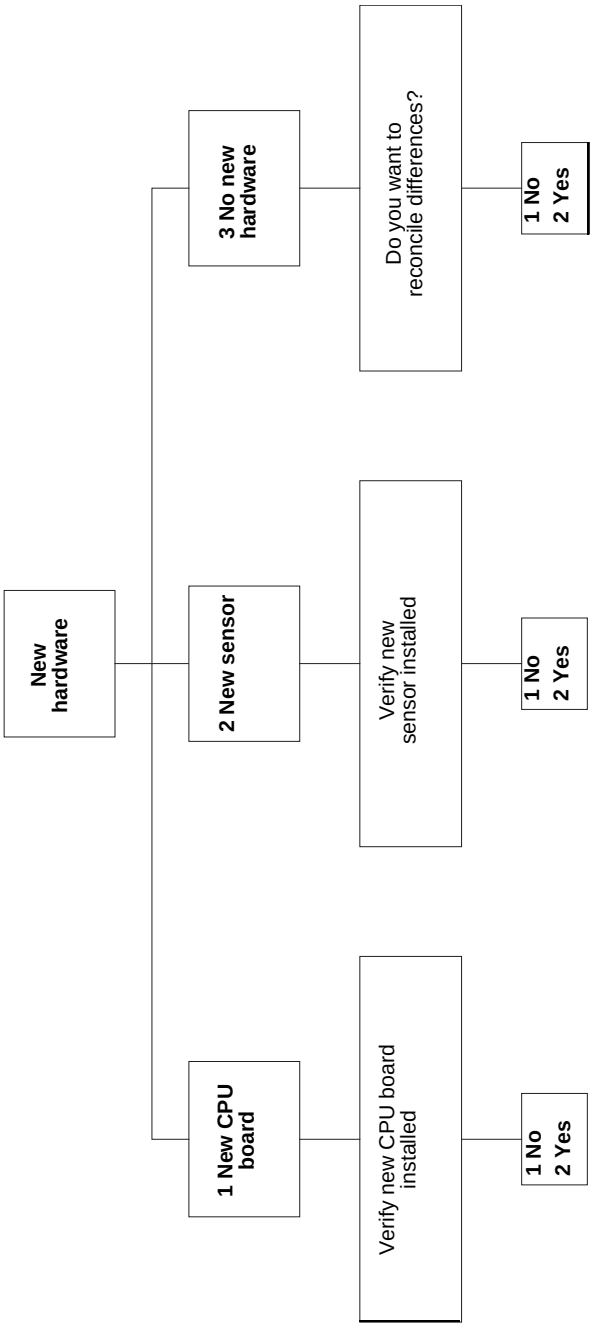


Figure D.19 New hardware

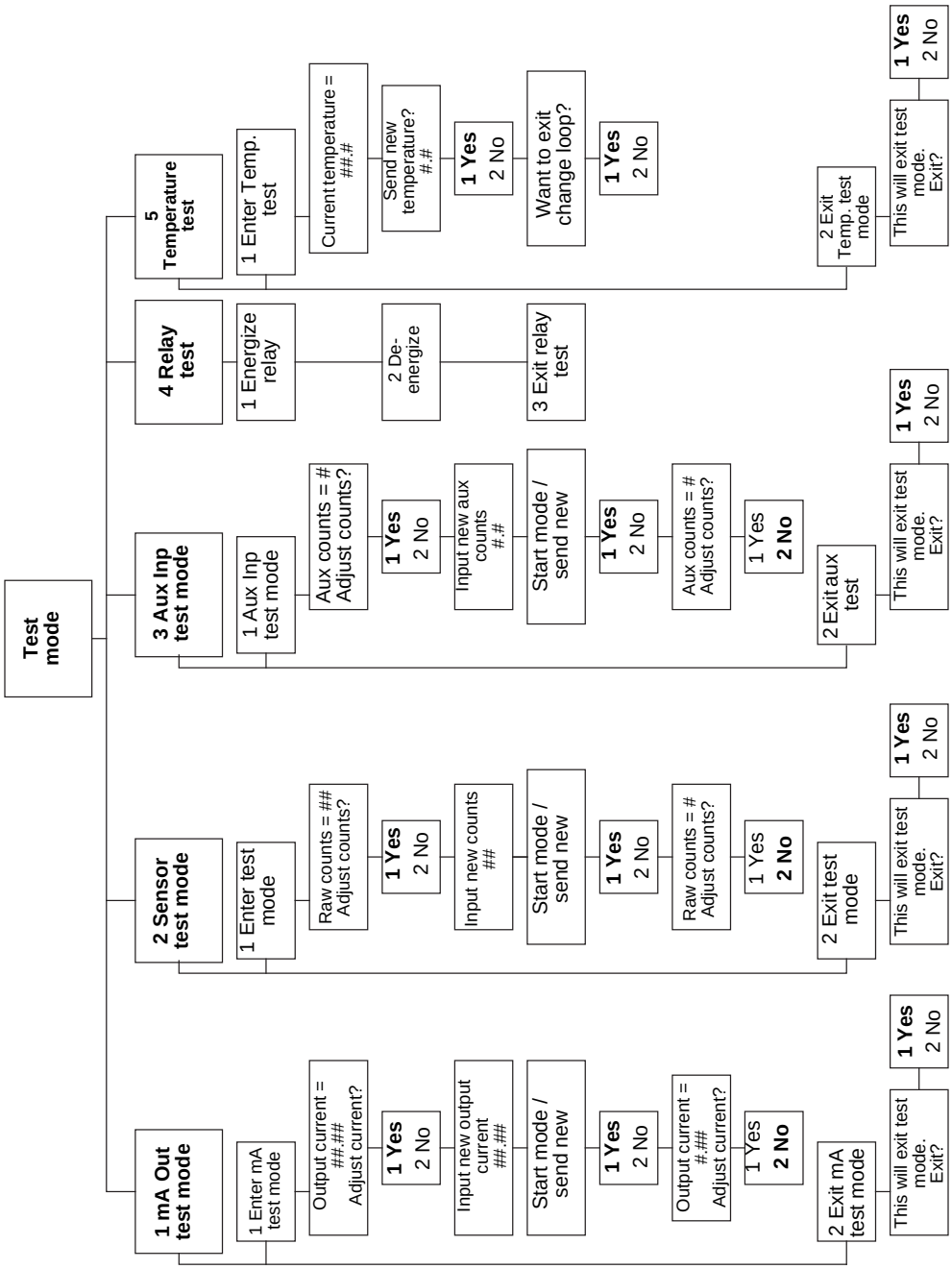


Figure D.20 Test mode

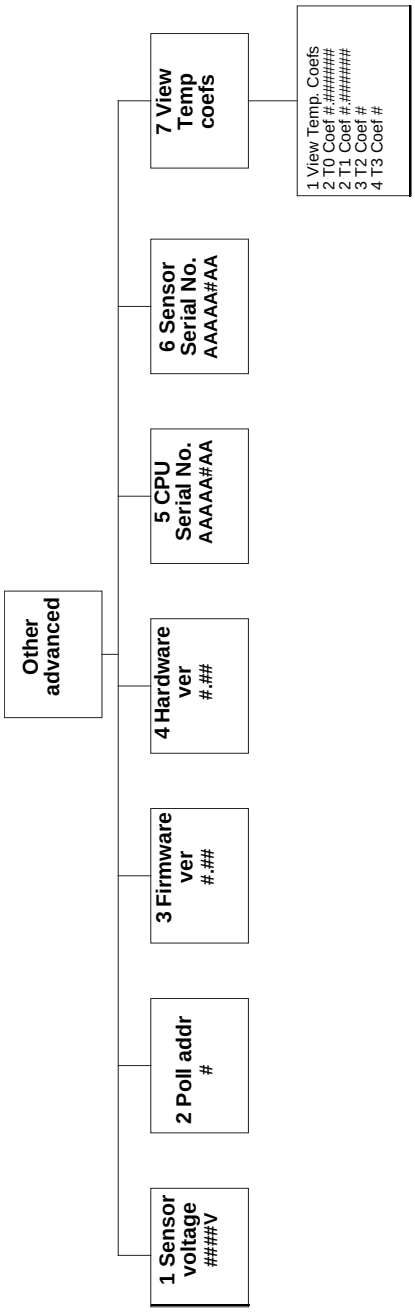

Other advanced
1 Sensor voltage #####v
2 Poll addr #
3 Firmware ver #.##
4 Hardware ver #.##
5 CPU Serial No. AAAAA#AA
6 Sensor Serial No. AAAAA#AA
7 View Temp coefs
1 View Temp. Coefs
2 T0 Coef #.######
2 T1 Coef #.######
3 T2 Coef #
4 T3 Coef #

Figure D.21 Other advanced

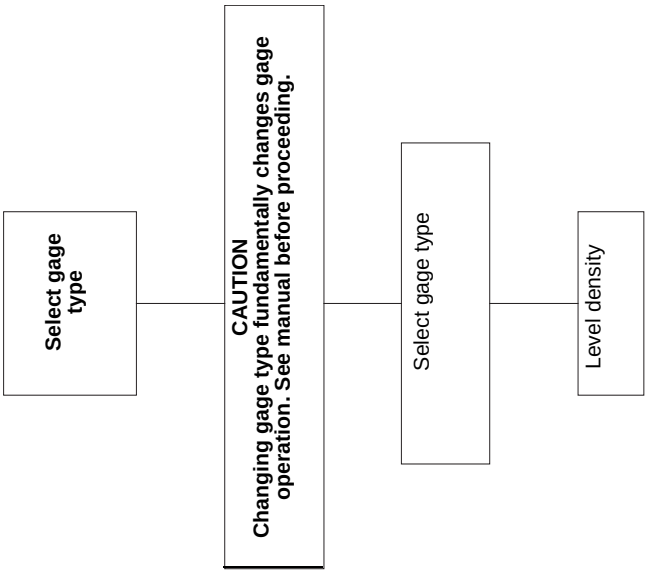

Select gage type
CAUTION
Changing gage type fundamentally changes gage operation. See manual before proceeding.
Select gage type
Level density

Figure D.22 Select gage type

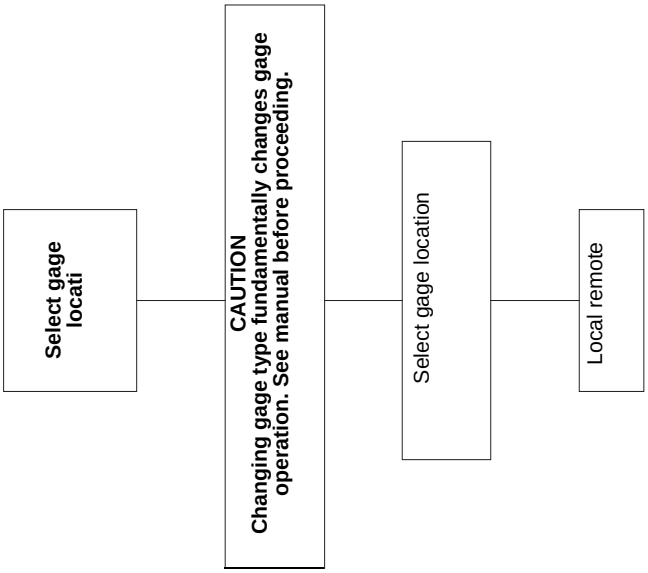

Select gage locati
CAUTION
Changing gage type fundamentally changes gage operation. See manual before proceeding.
Select gage location
Local remote

Figure D.23 Select gage location

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VEGA Americas, Inc.
4170 Rosslyn Drive
Cincinnati, Ohio 45209 USA
Phone: 1.513.272.0131
Fax: 1.513.272.0133
E-mail: americas@vega.com
www.vega-americas.com

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